Exhibit 49

**IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
WACO DIVISION**

ACQIS LLC,	
Plaintiff,	Case No. 6:22-cv-385-ADA
v.	
	JURY TRIAL DEMANDED
MICROSOFT CORPORATION,	
Defendant.	
ACQIS LLC,	
Plaintiff,	Case No. 6:22-cv-386-ADA
v.	
	JURY TRIAL DEMANDED
SONY INTERACTIVE ENTERTAINMENT INC., SONY INTERACTIVE ENTERTAINMENT LLC,	
Defendants.	

**EXPERT DECLARATION OF NABIL J. SARHAN, PH.D.
<u>REGARDING CLAIM CONSTRUCTION</u>**

I. INTRODUCTION

1.   I have been retained by ACQIS LLC ("ACQIS") as an expert with regard to these litigations. In that capacity, I have been asked to provide my opinions regarding the meaning of certain terms and the disclosure of the intrinsic record in view of a person of ordinary skill in the art in relation to U.S. Pat. Nos. 8,977,797 ("'797"); 9,529,768 ("'768"); 9,703,750 ("'750"); RE44,654 ("'654"); and RE45,140 ("'140") (collectively, "ACQIS patents-in-suit"). I have also been asked to respond to certain opinions offered in the Declaration of Andrew Wolfe, Ph.D., dated May 18, 2023, and the Declaration of Robert P. Colwell, Ph.D. in Support of Defendants' Consolidated Opening Claim Construction Brief, dated May 18, 2023, both of which were submitted by Defendants Microsoft and Sony in support of their claim construction briefing in the above-captioned matters.

2.   I offer this declaration in support of ACQIS's positions regarding claim construction and to provide relevant background information. Unless otherwise noted, the statements made herein are based on my personal knowledge, and if called to testify in Court, I could and would testify competently and truthfully with regard to this matter.

3.   My name is Nabil J. Sarhan, Ph.D. I have prepared this declaration in my capacity as an independent consultant. This declaration was prepared at the request of Robins Kaplan LLP on behalf of its client, ACQIS. The purpose of this declaration is to describe, from the perspective of a person of ordinary skill in the art, as applicable, the intrinsic record of the ACQIS patents-in-suit and the meaning of terms used in those patents in light of intrinsic and extrinsic evidence. I understand this declaration is to be used in the matters of *ACQIS LLC v. Microsoft Corp.*, Case No. 6:22-cv-00385-ADA (W.D. Tex.) and *ACQIS LLC v. Sony Interactive Entertainment, LLC, et al.*, Case No. 6:22-cv-00386-ADA (W.D. Tex.). I have been asked to review the ACQIS patents-in-suit and related materials and, based upon that review, to provide

my expert opinions.

4.   As an independent expert witness in this case, I am being paid for my work on this case at an hourly rate plus reimbursement of direct expenses, and my compensation is not dependent on the outcome of the litigation or the content of my declaration or any other expert reports I may provide. I have no personal interest in this litigation. I have no professional or financial connections to any party. In the past four years, I have testified once at trial and once at deposition.

5.   I expect to testify at trial concerning my educational and professional background described in this report and my curriculum vitae attached as Appendix A to this declaration. I am an internationally recognized expert in computer systems and computer networking, with a focus on multimedia applications and multimedia computing and networking, with over twenty years of experience in the field.

6.   My opinions and conclusions are fully discussed in later sections of this declaration. In reaching these opinions and conclusions, I have relied upon my education, my experience, and my training, and considered and relied upon my review of the ACQIS patents-in-suit and the patent prosecution histories, reexamination histories, and *inter partes* review proceedings, as applicable, for the ACQIS patents-in-suit and their numerous related applications and patents, claim construction materials from previous litigations involving patents related to the ACQIS patents-in-suit, including claim construction orders and expert reports/declarations, and my review of the intrinsic support and extrinsic evidence cited by the parties in their respective claim construction disclosures, including the declaration provided by Defendants' expert, Dr. Andrew Wolfe. I reviewed written expert testimony and analysis from previous cases.

7.   I reserve any right that I may have to supplement this declaration if further

information becomes available or if I am asked to consider additional information, including modified proposed constructions from Defendants. Furthermore, I reserve any right that I may have to consider and comment on any additional expert statements and testimony of Defendants' experts in this matter.

II.   QUALIFICATIONS

8.   I received my Ph.D. and M.S. degrees in Computer Science and Engineering from the Pennsylvania State University (Penn State) in 2003 and a B.S. degree in Electrical Engineering from Jordan University of Science and Technology in 1995. Both my M.S. thesis and Ph.D. dissertation considered the design of computer systems. Specifically, my Ph.D. dissertation dealt with the design of high-bandwidth I/O systems (particularly storage systems, including network-attached storage) for multimedia applications.

9.   I am an Associate Professor of Electrical and Computer Engineering (ECE) at Wayne State University and the Director of Wayne State Computer Systems and Deep Learning Research Laboratory. I am the Coordinator of the Interdisciplinary College of Engineering M.S. in AI Program and the Director of the Hardware and System Track. I served as the Graduate Program Director of Electrical and Computer Engineering and the Chair of the College of Engineering Faculty Assembly. I also served as the Director of the Wayne State Multimedia Computing and Networking Research Laboratory in the ECE department for approximately fifteen years. I am chairing the Computer Engineering Area in the ECE department, and I regularly teach undergraduate and graduate courses in computer architecture and computer networks and supervise Ph.D. and M.S. students.

10.   I have been regularly teaching the senior-level Computer Architecture course (previously called Computer Organization and Design) since 2003. The course covers

microprocessor design, memory hierarchy, and I/O. I have also been teaching the Computer

Networks and Network Programming course, which includes coverage of all network layers

(including the physical layer) and different network protocols. Additionally, I taught multiple

times the Advanced Computer Architecture course, which focuses on the design of parallel

computer systems and covers microprocessor design, memory hierarchy, and I/O. I have recently

developed a new course titled "Object-Oriented Programming for Electrical and Computer

Engineering" and led the efforts to modernize the Introduction to Microcomputers course and lab

by using ARM-based microcontrollers and the instruction set. Other courses that I taught include

Scalable and Secure Internet Services and Architectures, Special Topics on Multimedia, Special

Topics on Multimedia Networking, Special Topics on Multimedia Systems and Networks,

"Microcomputer Systems and Programming," and "Microprocessor Interfacing Lab." The

"Microcomputer Systems and Programming" course covered parallel and serial interfacing. The

Microprocessor Interfacing Lab focused on how to connect peripherals to the microprocessor

through parallel and serial interfacing and how to program the microprocessor at the assembly

language level to interface with such I/O devices.

11.   I supervised eight Ph.D. dissertations and four master theses related to computer

systems with a focus on multimedia, and I am currently supervising two Ph.D. dissertations in

these areas of research.

12.   I authored more than 50 refereed papers, including those in top journals and

conferences in various areas including computer systems, multimedia, networking, deep

learning, and I/O. I have recently been awarded (with a collaborator) a grant from the National

Science Foundation (NSF) to develop a reconfigurable hardware accelerator chip and system for

deep learning and artificial intelligence. The project includes the design of inference-engine

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chips that are interconnected through PCI Express to build a scalable system supporting large neural models. Three of my other research projects were also sponsored by the NSF. One of these projects was on video streaming while another was on the design of a multimedia system, specifically an automated video surveillance system for automatic detection of threats, utilizing cross-layer optimization. Another NSF-sponsored project was on reconfigurable high-performance cluster computing and medical engineering applications. Other research projects were sponsored by Silicon Mechanics and Sun Microsystems. These projects include "High Performance Computing Cluster" and "Sun's Center of Excellence in Open Source Computing and Applications." I am the named inventor on U.S. Patent No. 9,313,463 related to the design of automated video surveillance systems. My additional expertise in multimedia systems is also related to the ACQIS patents, which include video aspects, such as interfacing with video displays using TMDS and LVDS technologies, integrated graphics subsystems, and video memory.

13.   I served as the Chair of the Interest Group on Media Streaming of the Institute of Electrical and Electronics Engineering (IEEE) Multimedia Communication Technical Committee and as the Co-Director of the IEEE Multimedia Communication Technical Committee Review Board. I also served as an Associate Editor of the IEEE Transactions on Circuits and Systems for Video Technology. I served as a Guest Editor and Reviewer for prestigious journals and magazines. I have been involved in the organization of numerous international conferences in various capacities, including General Chair, Chair, Technical Program Committee Co-Chair, Publicity Chair, Track Chair, Session Chair, and Technical Program Committee Member. For example, I served as Co-Chair of the Technical Program Committee of ACM SIGMM Workshop on Network and Operating Systems Support for Digital Audio and Video (NOSSDAV) in 2018.

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I participated as a Panelist in major international conferences.

14.   I served as a Panelist for the National Science Foundation and the National

Institute of Health and as a Site Review Panelist for the Natural Sciences and Engineering

Research Council of Canada.

15.   I have been extensively involved in internal and international educational reform,

review, and accreditation activities. I also served as an external expert in reforming computer

science and computer engineering programs and courses. I served as the chair of 13 international

panels and as a member of seven international panels for the review and accreditation of

institutions and undergraduate and graduate programs, including "electrical engineering,"

"electrical and computer engineering," "software engineering," "computer and network

engineering," "computer science," and "information technology." I am a Program Evaluator for

Accreditation Board for Engineering and Technology (ABET)/IEEE.

16.   I received the *IEEE SEM Outstanding Professional of the Year Award*, the *Wayne

State University President's Award for Excellence in Teaching*, and the *College of Engineering

Excellence in Teaching Award*. I am a Senior Member of the Institute of Electrical and

Electronics Engineering (IEEE).

17.   I have recently been inducted into the *WSU Academy of Teachers* for having "a

significant impact on the WSU undergraduate learning experience," practicing "innovative

pedagogy," and demonstrating "instructional excellence."

18.   My CV is attached to this report as Appendix A which details additional

academic, professional, and litigation activities with which I have been involved over the past

four years.

III.   BASIS FOR OPINIONS

19.   In the course of conducting my analysis, I reviewed the ACQIS patents-in-suit and their respective prosecution histories, as well as the prosecution histories for applications related to the ACQIS patents-in-suit, in addition to the other materials described above. My opinions express my understanding of the meaning of these materials and the terms used in them. I have also relied on my more than 25 years of personal experience in research and education.

20.   It is my opinion that a person of ordinary skill in the art ("POSITA") concerning the technology described and claimed in the ACQIS patents-in-suit would typically have a B.S. degree in computer engineering or the equivalent, and approximately two years of experience including research and/or development in computer systems, networking, computer architecture, and/or I/O interconnects. Additional graduate education could substitute for professional experience, while significant experience in the field might substitute for formal education. This definition of a POSITA would not change whether the time of the alleged invention is deemed to be 1998, 1999, or 2000. I educate, mentor, train, and work with such persons of ordinary skill in the art as a teacher, academician, and researcher.

21.   Based on my experience, I am qualified to render opinions regarding the interconnect technology claimed and described in the ACQIS patents-in-suit, including as it relates to PCI- and USB-related functionality. Based on my expertise and qualifications, I am qualified to provide an opinion as to what a POSITA would have understood, known, or concluded as of the timeframe between approximately 1998 and 2000.

22.   I reserve the right to supplement the list of materials relied upon in forming the opinions expressed in this declaration, or that I may use to summarize or support the opinions expressed in this declaration, in light of any new information or positions that Defendants are permitted to introduce after the submission of this declaration.

23.   I further reserve the right to prepare demonstrative exhibits for use in conjunction with testimony I may give at any claim construction hearing or tutorial, if asked to do so.

IV.   OPINIONS REGARDING CLAIM CONSTRUCTION

24.   I understand the parties have proposed a number of claim terms and phrases for construction by the Court, and that the parties have offered competing proposed constructions for these claim terms and phrases. In the sections that follow, I offer my opinions as a person of ordinary skill in the art on the construction of certain of these claim terms and phrases.

A.   Relevant Legal Principles

25.   For the purposes of this declaration, I have been informed about certain aspects of the law that are relevant to my analysis and opinions. I have applied these legal principles in rendering my opinions below.

26.   I understand that the ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention. I understand the time of the invention to be sometime between 1998 at the earlier and 2000 at the latest. I understand that in the absence of an express intent on the part of the inventor to give special meaning to the claim terms, the words are presumed to take on the ordinary and customary meanings attributed to them by a person of ordinary skill in the art.

27.   I understand that the basis for a term's ordinary and customary meaning may be derived from a variety of sources, including the words of the claims themselves, the remainder of the specification, the prosecution history, and extrinsic evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art at the time of the invention.

28.   I have been instructed that dictionary definitions or definitions from technical

references can be used to inform or confirm the ordinary and customary meaning of words found in a claim, but that in construing claim terms, the general meanings gleaned from reference sources, such as dictionaries, must always be compared against the use of the terms in the context of the claim itself.

29.   I understand that a patent applicant is entitled to be his or her own lexicographer (in order words, provide his or her own meaning to a word or phrase) and may rebut the presumption that claim terms are to be given their plain and ordinary meaning. To do so, the applicant must clearly set forth a definition of the term that is different from its ordinary and customary meaning. Where the applicant provides an explicit definition for a term, that definition will control the interpretation of the term as it is used in the claim in which it appears. I understand that the specification can also be relied on for more than just explicit lexicography to determine the meaning of a claim term. For example, I understand that the meaning of a particular claim term may also be determined by implication, that is, according to the usage of the term in the context of the specification.

B.   "low voltage differential signal (LVDS) [channel]" / "LVDS [channel]"

30.   I understand the ACQIS patent-in-suit and the claims ACQIS has asserted against Microsoft and/or Sony recite the term "low voltage differential signal (LVDS) channel" or "LVDS channel."

31.   In relation to these terms, I have reviewed the materials identified above, and in particular the opinions set forth in the Declaration of Andrew Wolfe, Ph.D. I disagree with many of the opinions expressed by Dr. Wolfe, as specified below.

32.   Dr. Wolfe contends "[a] POSITA would have understood that LVDS was defined in two relevant industry standards," ANSI/TIA/EIA-644 and IEEE 1596.3. Wolfe Decl., ¶ 28. I

disagree. As discussed below, in the late 1990s at the time of the invention, a POSITA would

have understood that "LVDS" could be used to refer to a specific standard or be used in a generic

manner, as used in, for example, the *VESA Plug & Display Standard* Ver. 1, Rev. 0 (June 11,

1997) ("VESA P&D Standard"), as discussed below. Dr. Wolfe is incorrect to focus only on the

two standards, ANSI/TIA/EIA-644 and IEEE 1596.3, discussed in the Wolfe Declaration.

33.   Dr. Wolfe points to two related statements: "two key industry standards define

LVDS," Wolfe Decl., ¶¶ 31-33, and "[t]here are two industry standards that define LVDS." *Id.*, ¶

34. As explained below, a POSITA would recognize that these two standards "define" specific

types of LVDS, not that they define **every** kind of "LVDS" technology, which as discussed

below, has a broader meaning.

34.   In his conclusion that a "POSITA would have understood that LVDS refers to **the**

technology described in ANSI/TIA/EIA-644 or IEEE 1596.3" (emphasis added), Dr. Wolfe

fails to consider that the specifications of the ACQIS patents-in-suit unequivocally explain that

they use "LVDS" according to its ordinary, generic meaning not limited to any specific LVDS

technology:

> It is desirable to use a low voltage differential signal (LVDS) channel in the
> computer system of the present invention because an LVDS channel is more cable
> friendly, faster, consumes less power, and generates less noise, including
> electromagnetic interferences (EMI), than a PCI channel. **The term LVDS is**
> **herein used to generically refer to low voltage differential signals and is not**
> **intended to be limited to any particular type of LVDS technology.**

Ex. 1, '768 at 4:9-16 (emphasis added); Ex. 2, '750 at 4:11-18 (same); Ex. 3, '797 at 3:65-4:5

(same).

35.   The VESA P&D Standard, which is also cited art to the patents-in-suit, expresses

that "LVDS" had a recognized, generic meaning at the time:

> The term LVDS is used in this document as a generic term and does not imply
> and particular LVDS technology.

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Ex. 50, VESA P&D Standard, at 4.

36.   The patent specifications also clearly reinforce their broad conception of the

LVDS term by reciting that "TMDS stands for Transition Minimized Differential Signaling and

is a trademark of Silicon Images and refers to their Panel Link technology, **which is in turn a**

trademark for their LVDS technology. TMDS is used herein to refer to the Panel Link

technology or technologies compatible therewith." Ex. 1, '768 at 21:31-36 (emphasis added).

37.   The VESA P&D Standard describes an implementation of LVDS, called

"Transition Minimized Differential Signaling," or "TMDS" (branded PanelLink), not tethered to

any of the aforementioned LVDS standards. Ex. 50, VESA P&D Standard at 31-33. In the VESA

P&D Standard, the TMDS interface transmits video data serially at high speed to the receiver, *id.*

at 31, which receives "a low voltage differential signal" at its end of the transmission line. *Id.* at

33.

38.   The VESA P&D Standard requires compliance with many industry standards, but

not any relating to LVDS, further demonstrating that "LVDS" had a recognized generic

meaning. *Id.* at 5.

39.   Extrinsic evidence also confirms that "LVDS" has maintained a consistent,

recognized generic meaning since the ACQIS inventions. For example, the *Digital Visual*

Interface (DVI) Specification, Rev. 1.0 (Apr. 2, 1999) ("DVI 1.0") explains that "T.M.D.S.

technology uses current drive to develop the **low voltage differential signal** at the receiver side

of the DC-coupled transmission line." Ex. 51, DVI 1.0 at 33 (emphasis added).

40.   As a further example, a press release from April 2, 2001 shows that

HyperTransport uses LVDS:

> HyperTransport is the industry's lowest latency, highest-performance, fully
> scalable, packet-based interconnect technology serving a wide range of industry

segments. It is based on two 2-line to 32-line, asymmetric **Low Voltage Differential Signaling (LVDS)** links delivering up to 22.4 Gigabytes/second of aggregate CPU to CPU, CPU to I/O bandwidth in a highly efficient point-to-point, daisy-chain topology that replaces complex multi-level, multi-line buses.

See Ex. 52, HyperTransport Consortium Press Release (Apr. 2, 2001), at 2 (emphasis added).

41.   A 2001 whitepaper further describes the generic, non-standard LVDS used in

HyperTransport as follows:

The signaling technology used in HyperTransport technology **is a type of low voltage differential signaling (LVDS). However, it is not the conventional IEEE LVDS standard. It is an enhanced LVDS technique developed to evolve with the performance of future process technologies.** This is designed to help ensure that the HyperTransport technology standard has a long lifespan. LVDS has been widely used in these types of applications because it requires fewer pins and wires. This is also designed to reduce cost and power requirements because the transceivers are built into the controller chips.

Ex. 53, HyperTransport^{TM} Technology I/O Link, A High-Bandwidth I/O Architecture, AMD

White Paper (July 20, 2001), at 11 (emphasis added).

HyperTransport technology uses **low-voltage differential signaling** with differential impedance (ZOD) of 100 ohms for CAD, Clock, and Control signals, as illustrated in Figure 4. Characteristic line impedance is 60 ohms. The driver supply voltage is 1.2 volts, instead of the conventional 2.5 volts for **standard LVDS**.

Id. (emphasis added).

42.   In the 1998-1999 timeframe, "LVDS" had an objective, known meaning to those

of skill in the art. A POSITA would have understood that "LVDS" refers to a differential

signaling technique that allowed a voltage swing lower than prior data transmission standards,

such as ECL and PECL. *See* Ex. 26, "An Overview of LVDS Technology," Huq, S., et al.,

Application Note 971 (July 1998) ("Huq"), at 1-2.

43.   The art cited in the ACQIS patents-in-suit shows that, by the 1998-1999

timeframe, "LVDS" had a well-recognized meaning objectively defined by reference to prior

data transmission standards. For example, Huq, published in 1998 by National Semiconductor,

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explains:

> As the name implies, **LVDS features a low voltage swing compared to other industry data transmission standards**. The signaling levels are illustrated in Figure 1, and a comparison to PECL levels is also shown as reference. Because of the low swing advantage, LVDS achieves a high aggregate bandwidth in point-to-point applications.

Ex. 26, Huq at 1 (emphasis added).

44.   I disagree with several other of Dr. Wolfe's statements regarding LVDS. Those disagreements are further set forth below.

45.   Dr. Wolfe contends "a POSITA would have understood that the use of the known, capitalized acronym, 'LVDS,' was meant to refer to a specific technology, as defined by the standards above," i.e., ANSI/TIA/EIA-644 and IEEE 1596.3. Wolfe Decl., ¶ 36. I disagree. As discussed above, "LVDS" in the late 1990s had a recognized, generic meaning, consistent with the VESA P&D Standard and the statements in the ACQIS patents-in-suit.

46.   A POSITA in the 1998-1999 timeframe would not have limited the generic term "LVDS" to the two standards Dr. Wolfe identifies, especially in view of the specifications of the ACQIS patents-in-suit.

47.   In my opinion, it is telling that both standards relied upon by Dr. Wolfe purport to describe "LVDS." The fact that two different standards both describe "LVDS" indicates that "LVDS" had a more generic meaning than the specific technologies in either standard.

48.   Again, the ACQIS patents-in-suit contradict Dr. Wolfe's and Defendants' narrow definition of "LVDS" by describing a known example of LVDS, TMDS as used in PanelLink, different from the standards Dr. Wolfe relies upon:

> P&D stands for plug and display and is a trademark of the Video Electronics Standards Association (VESA) for the Plug and Display standard . . . . **TMDS stands for Transmission Minimized Differential Signaling and is a trademark of Silicon Images and refers to their Panel Link technology, which is in turn**

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a trademark for their LVDS technology. TMDS is used herein to refer to the
Panel Link technology or technologies compatible therewith.

Ex. 1, '768 at 21:25-36 (emphasis added); Ex. 2, '750 at 21:23-34; Ex. 3, '797 at 20:43-54; Ex.

4, '654 at 21:9-19; Ex. 5, '140 at 21:13-23.

49.   A POSITA would recognize that TMDS does not follow either ANSI/TIA/EIA-

644 or IEEE 1596.3. Dr. Wolfe fails to recognize TMDS/PanelLink as an example of LVDS

technology, even though it is explicitly identified in the specifications of the patents-in-suit.

50.   The fact that VESA understood and could implement "LVDS" as a "generic term"

indicates that a POSITA would have understood its scope with reasonable, if not absolute,

certainty. Ex. 50, VESA P&D Standard, at 4-5, 31-33.

51.   The art cited in the ACQIS patents-in-suit and extrinsic evidence demonstrates

that a POSITA understood that "LVDS" utilized lower voltage than existing data transmission

techniques such as ECL and PECL.

52.   I, therefore, disagree with Dr. Wolfe's contention that a POSITA "***would not***

understand the scope of the term 'low voltage differential signal' with any reasonable certainty

unless it is defined in the context of the well-known standards defining the same." Wolfe Decl.,

¶ 43. In my opinion, "low voltage differential signal (LVDS) [channel]" and "LVDS [channel]"

are not indefinite.

C.   **"PCI bus transaction"**

53.   I understand the ACQIS patent-in-suit and certain of the claims ACQIS has

asserted against Microsoft and/or Sony recite the term "PCI bus transaction."

54.   I understand other ACQIS experts, including Dr. Marc Levitt, have provided

opinions regarding claim construction issues involving the ACQIS patents-in-suit, including on

the "PCI bus transaction" term. I have reviewed Dr. Levitt's declaration and rebuttal declaration, which he provided in the *ACQIS v. Samsung* matter, and agree with the substance of the opinions Dr. Levitt offered. I do not seek to recreate that analysis here. Instead, I seek to address narrow issues relating to the parties' dispute over the construction of "PCI bus transaction."

55.   In relation to this term, I have reviewed the materials identified above, and in particular, the opinions set forth in the Declaration of Robert P. Colwell, Ph.D. in Support of Defendants' Consolidated Opening Claim Construction Brief. I disagree with many of the opinions expressed by Dr. Colwell, as specified below.

56.   Dr. Colwell contends that ACQIS's proposed construction of "PCI bus transaction," i.e., "a transaction, in accordance or backwards compatible with the industry standard PCI Local Bus Specification, for communication with an interconnected peripheral component," is incorrect in its inclusion of "or backwards compatible" because "it broadens the scope of the claim term beyond what a POSITA would have understood at the time and beyond what the Federal Circuit held the term to mean." Colwell Decl., ¶ 35. He further contends, "Specifically, ACQIS's construction improperly expands the construction to include a separate class of transactions not in accordance with, but only backwards compatible with, the PCI Local Bus Specification." *Id.*

57.   I disagree with Dr. Colwell's assertions. First, I understand that this Court, in parallel ACQIS proceedings, has already found that "backwards compatibility" is not in conflict with the Federal Circuit's decision in *EMC*, concluding "in accordance with" includes "backwards compatibility" and that "adding 'backwards compatibility' does not expand the claim scope." Ex. 54, *ASUSTeK*, Dkt. 124 at 36:6-16.

58.   I therefore disagree with Dr. Colwell's assertion that "Plaintiff's construction is

contrary to, and not consistent with, the Federal Circuit's adopted claim construction." Colwell

Decl., ¶ 36. In my opinion, a POSITA would agree that "in accordance with" in the construction

of "PCI bus transaction" would include "backwards compatibility," and such POSITA would

have understood the scope of the claims accordingly, based on the intrinsic evidence as discussed

below.

59.   Further, although the phrase "backwards compatible" does not appear in the

Asserted Patents, the concept of backwards compatibility does. The ACQIS patents-in-suit

indicate to a POSITA that the inventor recognized that it was important to communicate with

PCI peripherals without requiring modification of the existing standard drivers, i.e., "without

changes in operating system and application software." Ex. 1, '768 at 4:64-5:6.

60.   The ACQIS patents-in-suit also describe maintaining the PCI standard address

format, address space, data format, transaction ordering, and command types, ensuring that the

transaction is backwards-compatible for use with existing software, such that no new drivers are

needed to make the peripherals work on the system. *Id.*

61.   The ACQIS invention replaces the parallel PCI bus and corresponding control

signals with a serial interface employing LVDS channels. *Id.* at 5:47-6:11, 6:41-52. The

invention also maintains compatibility with the PCI bus:

> The present invention overcomes the aforementioned disadvantages of the prior art
> [i.e., PCI] by interfacing two PCI or PCI-like buses using a non-PCI or non-PCI-
> like channel. In the present invention, PCI control signals are encoded into control
> bits and the control bits, rather than the control signals they represent, are
> transmitted on the interface channel. At the receiving end, the control bits
> representing control signals are decoded back into PCI control signals prior to being
> transmitted to the intended PCI bus. . . . [T]he present invention advantageously
> uses an LVDS channel for the hereto unused purpose of interfacing PCI or PCI-like
> buses.

Id. at 5:47-6:3.

62.   The specification describes an embodiment of the invention, referred to as the

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"XPBus," that receives and transmits "PCI address and data" information, (*id.* at 18:11-27), and "may be used to interface two PCI or PCI-like buses . . . ." *Id.* at 18:50-62.

63.   A POSITA would also recognize that various embodiments of the invention have no parallel PCI bus at all and completely replace the architecture with serial architecture. *Id.* at Figs. 8A, 8B.

D.   "USB" Terms

64.   I understand the ACQIS patent-in-suit and certain of the claims ACQIS has asserted against Microsoft and/or Sony recite certain "USB" terms, i.e., "USB," "Universal Serial Bus (USB) protocol," and "Universal Serial Bus (USB) protocol [data/information]."

65.   In relation to these terms, I have reviewed the materials identified above, and in particular, the opinions of Dr. Colwell. I disagree with certain of the opinions expressed by Dr. Colwell, as specified below.

66.   I agree with Dr. Colwell that "[t]here is a significant technological difference between USB 2.0 (and earlier specifications) and USB 3.0 and later versions of the specifications (e.g., half-duplex to full duplex)." Colwell Decl., ¶ 43. This is correct; USB 2.0 (and earlier specifications) is half-duplex and USB 3.x is full duplex. This means that in USB 2.0, data is transmitted using a bidirectional differential signal pair (*see* Ex. 46, USB 2.0 at 17 (Figure 4-2) (showing bidirectional D+/D- data wires)), and data can only be transmitted in one direction at a time. In USB 3.x, data can be transmitted in both directions at the same time on separate unidirectional, differential signal pairs.

67.   I disagree with Dr. Colwell's opinion that "a POSITA reading the Asserted Patents would have understood that the USB described in the specification referred to USB 2.0 or earlier versions and that the claimed 'Universal Serial Bus (USB) protocol [data/information]'

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was conveyed in accordance with USB 2.0, or earlier, specifications." Colwell Decl., ¶ 43. As

noted above, USB 2.0 is half-duplex. The relevant "USB" Asserted Claims of the ACQIS

patents-in-suit all recite unidirectional, serial channels that transmit data in opposite directions,

i.e., full duplex, which is completely different from USB 2.0. For this reason, a POSITA would

not read the Asserted Claims to require conveying USB protocol data/information "in accordance

with USB 2.0, or earlier, specifications."
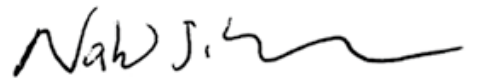
68.   Moreover, a person of skill in the art would understand any generation of the USB

protocol to qualify as "USB" under the plain and ordinary interpretation of that term. A POSITA

would further understand that when a specific version (or generation) of USB is intended, then

the number of that version should be given, such as USB 1.0, USB 1.1, USB 2.0, etc. This

naming convention is known not only to a POSITA but also to the average computer user.

69.   Furthermore, as with other popular standardized protocols, the specifications of

USB have been revised continually while ensuring backward compatibility, and USB was known

as an evolving protocol at the time of the inventions of the Asserted Patents. All claim

limitations are not tied to any specific version of USB, although the patent specifications

occasionally refer to a specific version of USB as an example. These claim limitations refer

generically to "USB protocol information" or "USB protocol data" (and similar terms), which a

POSITA would not limit to a particular generation, and which a POSITA would understand to

encompass iterative changes to then-extant versions of USB protocols. I see references to the

USB 2.0 standard in the Asserted Patents as "permissive" references. *See, e.g.*, '768 at 12:16-18

("Other types of network connection devices can also be used. For example, the invention can

use Gbit Ethernet 1394, and USB 2.0."), 12:29-32 ("The implementation is not restricted to

Ethernet serial communication and can use other high-speed serial communication Such as USB

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2.0, and 1394."). Other references to USB in the specification are generic and not limited to version 2.0. *See, e.g.*, *id.* at 12:56-58 ("Optionally, the keyboard/mouse Switch also couples to a second keyboard/mouse 259 via PS2 or USB signal line 251.").

I declare under penalty of perjury that the foregoing is true and correct.

Executed this 9th day of June, 2023, at Dearborn Heights, Michigan.

Nabil J. Sarhan, Ph.D.

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Appendix A

Nabil J. Sarhan, Ph.D.

http://nabil.eng.wayne.edu/
https://deeplearning.eng.wayne.edu

Dept. of Electrical & Computer Engineering

Wayne State University

5050 Anthony Wayne Drive

Detroit, MI 48202

Phone: (313) 577-2860

nabil.sarhan@wayne.edu

Appointments

- Associate Professor with Tenure, Electrical and Computer Engineering, Wayne State University, Detroit, August 2009 - Present.

- Director, Wayne State Computer Systems and Deep Learning Research Laboratory, Dept. of Electrical and Computer Engineering, Wayne State University, Detroit, August 2018 - Present.

- Director, Interdisciplinary M.S. in AI Program (Systems and Hardware), College of Engineering, Wayne State University, Detroit, August 2022 – Now.

- Overall Coordinator, Interdisciplinary M.S. in AI Program, College of Engineering Wayne State University, Detroit, August 2022 – Now.

- Director, Wayne State Multimedia Computing and Networking Research Laboratory, Dept. of Electrical and Computer Engineering, Wayne State University, Detroit, August 2003 – July 2018.

- Graduate Program Director, Electrical and Computer Engineering, Wayne State University, Detroit, August 2011 - January 2013.

- Assistant Professor, Dept. of Electrical and Computer Engineering, Wayne State University, Detroit, August 2003 - August 2009.

- Graduate Lecturer/Teaching Assistant/Research Assistant, Dept. of Computer Science and Engineering, Pennsylvania State University, University Park, June 1999 - August 2003.

- Intern, Unisys, Malvern, Pennsylvania, May 2002 - September 2002: I participated in discussions of new multiprocessor systems, made proposals for new architectures,

developed SES models, and developed an automatic statistic extraction and post-analysis tool.

- Engineer, Voice Processing Dept., Jordan Computer Center, Amman, Jordan, November 1995 - February 1996: I was responsible for developing phone bank and voice-mail systems.

Expert Witness and Consulting Experience in Patent Infringement and Other Litigation

- Expert Witness and Consulting Expert, patent infringement case, ACQIS v. Sony, on the plaintiff's side, areas of the patents: computer systems with LVDS channels, serial interfacing, graphics, PCI transactions, USB, etc., April 2023 – Now.

- Expert Witness and Consulting Expert, patent infringement case, ACQIS v. Microsoft, on the plaintiff's side, areas of the patents: computer systems with LVDS channels, serial interfacing, graphics, PCI transactions, USB, etc., April 2023 – Now.

- Expert Witness and Consulting Expert, patent infringement case, ACQIS v. Wiwynn, on the plaintiff's side, areas of the patents: computer systems with LVDS channels, serial interfacing, graphics, PCI transactions, USB, etc., January 2022 – Now.

- Expert Witness and Consulting Expert, patent infringement case VideoShare v. Meta (Facebook), on the plaintiff's side, patent: "Systems and Methods for Sharing Video with Advertisements over a Network", November 2021 – March 2023.

- Expert Witness and Consulting Expert, patent infringement case including validity, ACQIS v. Lenovo, on the plaintiff's side, areas of the patents: computer systems with LVDS channels, serial interfacing, graphics, PCI transactions, USB, etc., January – November 2022.

- Expert Witness and Consulting Expert, patent infringement case VideoShare v. Google, on the plaintiff's side, patent: "Systems and Methods for Sharing Video with Advertisements over a Network", July 2020 - November 2021.

- Consulting Expert, a patent infringement case related to video sharing and streaming systems, February 2020 - October 2020.

- Source Code Reviewer, a patent infringement case related to Web and mobile video apps, involving a major social media company, February 2021.

- Consulting Expert, a patent infringement case related to video streaming and multimedia systems: Visual Interactive Phone Concepts (VIPC) v. US Cellular, 2014 - 2015.

- Consulting Expert, a patent infringement case related to video streaming: Visual Interactive Phone Concepts (VIPC) v. Verizon, on the Plaintiff's side, 2012 – 2014.

- Consulting Expert, a patent infringement case related to video streaming: Visual Interactive Phone Concepts (VIPC) v. US Cellular, on the Plaintiff's side, 2012 - 2014.

- Consulting Expert, a patent infringement case related to video streaming: Visual Interactive Phone Concepts (VIPC) v. Google, on the Plaintiff's side, 2012 - 2014.

- Consulting Expert, a patent infringement case related to video streaming: Visual Interactive Phone Concepts (VIPC) v. Samsung, on the Plaintiff's side, 2012 - 2014.

- Consulting Expert, an intellectual property corporate litigation case involving secure multimedia products for medical applications: MIANTS, LLC, a Michigan limited liability company, MATTHEW VISCONTI, M.D., an individual, SANDY VISCONTI, an individual, APG, LTD, a Canadian corporation, FELICE IAFRATE, ESQ, an individual, LARRY DAVIDSON, an individual, and CRYSTAL DAVIDSON, an individual, directly and derivatively on behalf of BRIGHT PURPLE ENCRYPTION, LLC, a Michigan limited liability company, and ENCRYPTION   SECURITY SOLUTIONS, LLC, a Michigan limited liability company v.   KEVIN LASSER, an individual, RAMIE PHILLIPS III, an individual, MEDTEDCO, LLC, a Michigan limited liability company, PHILLIPS CONSULTING, INC., a Michigan corporation, JEMS TECHNOLOGY, LLC, a Michigan limited liability company, DAVID UNDERDALE, an individual, TIMOTHY FOLEY, M.D., an individual, TRUDY HABLE, an individual, and ROBERT HUTH, an individual, on the plaintiff's side, 2014.

- Consulting Expert, a corporate litigation case involving IP addresses and anonymous e-mails: Integrated Health Group v. Integrated Healthcare Systems, on the Plaintiff's side, 2014.

Consulting Experience in Educational Reform, Review, and Accreditation

- Program Evaluator, Accreditation Board for Engineering and Technology (ABET)/IEEEE, 2023 – Now.

- Chair, Program Accreditation Panel, Education & Training Evaluation Commission, National Center for Academic Accreditation & Evaluation (ETEC-NCAAA): reviewing the B.S. Program in Computer Science at Prince Sattam bin Abdulaziz University, Saudi Arabia, May 2023.

- Chair, Program Accreditation Panel, Education & Training Evaluation Commission, National Center for Academic Accreditation & Evaluation (ETEC-NCAAA): reviewing the Bachelor of Electrical Engineering program at Northern Borders University, Saudi Arabia, February 2023.

- Chair, Program Accreditation Panel, Education & Training Evaluation Commission, National Center for Academic Accreditation & Evaluation (ETEC-NCAAA): reviewing the Bachelor of Science in Information Technology program at Majmaah University, Saudi Arabia, January 2023.

- Chair, Program Accreditation Panel, Education & Training Evaluation Commission, National Center for Academic Accreditation & Evaluation (ETEC-NCAAA): reviewing the Bachelor of Computer Science Program at Shaqra University, Saudi Arabia, November 2022

- Chair, Institutional Accreditation Panel, Education & Training Evaluation Commission, National Center for Academic Accreditation & Evaluation (ETEC-NCAAA): reviewing University of Hafr Al Batin, Saudi Arabia, October-November 2021

- Member, Institutional Accreditation Panel, Education & Training Evaluation Commission, National Center for Academic Accreditation & Evaluation (ETEC-NCAAA): reviewing King Abdulaziz University, Saudi Arabia, February 2022

- Chair, Program Accreditation Panel, Education & Training Evaluation Commission, National Center for Academic Accreditation & Evaluation (ETEC-NCAAA): reviewing the Computer and Network engineering program at Jazan University, Saudi Arabia, October 2021

- Reviewer, the Academic Accreditation Policy Book 2021, Education & Training Evaluation Commission, Saudi Arabia, 2021

- Chair, Program Accreditation Panel, Education & Training Evaluation Commission, National Center for Academic Accreditation & Evaluation (ETEC-NCAAA): reviewing the Master of Science Program of Electrical Engineering at King Saud University, Riyadh, Saudi Arabia, March 2021

- Chair, Program Accreditation Panel, Education & Training Evaluation Commission, National Center for Academic Accreditation & Evaluation (ETEC-NCAAA): reviewing the Electrical Engineering Program at Najran University, Najran, Saudi Arabia, February 2021

- Chair, Program Accreditation Panel, Education & Training Evaluation Commission, National Center for Academic Accreditation & Evaluation (ETEC-NCAAA): reviewing the

Graphics Design and Digital Media Program at Princess Nourah Bint Abdulrahman University, Riyadh, Saudi Arabia, November 2020

- Chair, Program Accreditation Panel, Education & Training Evaluation Commission, National Center for Academic Accreditation & Evaluation (ETEC-NCAAA): reviewing the Electrical Engineering Program at Majmaah University, Al Majma'ah, Saudi Arabia, November 2020

- Chair, Program Accreditation Panel, Education & Training Evaluation Commission, National Center for Academic Accreditation & Evaluation (ETEC-NCAAA): reviewing the Electrical and Computer Engineering Program at Effat University, Jeddah, Saudi Arabia, September 2020

- Member, Institutional Accreditation Panel, Education & Training Evaluation Commission, National Center for Academic Accreditation & Evaluation (ETEC-NCAAA): reviewing Shaqra University, Shaqra, Saudi Arabia, October 2020

- Educational Expert, Digital Design Courses and Labs Revision, Computer Engineering Department, Birzeit University, Palestine, August 2018 – December 2018

- External Educational Expert, Computer Engineering and Computer Science Reform, Birzeit University, Palestine, February 2018 – June 2018

- Chair, Program Accreditation Panel, The National Commission for Academic Accreditation and Assessment (NCAAA): reviewing the Software Engineering Program at King Saud University, Riyadh, Saudi Arabia, May 2017

- Member, University Accreditation Panel, The National Commission for Academic Accreditation and Assessment (NCAAA): reviewing the University of Business and Technology, Jeddah, Saudi Arabia, May 2017

- Member, University Re-Accreditation Panel, Education Evaluation Commission-Higher Education Sector (EEC-HES): reviewing Effat University, Jeddah, Saudi Arabia, December 2016

- Chair, Program Accreditation Panel, The National Commission for Academic Accreditation and Assessment (NCAAA): reviewing the Electrical Engineering Program at Taibah University, Medina, Saudi Arabia, March 2016

- Member, Program Accreditation Panel, The National Commission for Academic Accreditation and Assessment (NCAAA): reviewing the Electrical Engineering Program at Prince Sattam University, Riyadh, Saudi Arabia, March 2016

- Member, Program Accreditation Panel, The National Commission for Academic Accreditation and Assessment (NCAAA): reviewing the Electrical Engineering Program at King Saud University, Riyadh, Saudi Arabia, April 2015

Other Consulting Experience

- Expert, Specialty Occupation evaluation of **numerous** H-1B visa cases for Software Developer, Software Engineer, Web Developer, Hadoop Developer, Database Administrator, Project Engineer, ServiceNow Developer, and PLM Engineer positions, 2018 - 2020.

Honors/Awards

- Was inducted into the *WSU Academy of Teachers* in 2022.
  - Induction statement: "Professor Nabil Sarhan is a master of developing project-based courses and new cutting-edge curricula for engineering students, such as a new M.S. degree in Artificial Intelligence. Students in his classes are immersed in a research-like environment with hands-on activities and training in technological problem-solving. This approach builds student interest and excitement as it prepares students for their future careers. Sarhan is an indefatigable innovator who has reformed multiple courses at the undergraduate and graduate levels based on design approaches and active learning. His courses are cutting-edge, covering topics from computer networks to artificial intelligence. Through industry grants and connections, he has also made 21st-century technology available to his students. As a member of the Academy of Teachers, Sarhan will be able to share his knowledge and experience of developing innovative and project-based STEM courses with instructors across Wayne State University".

- Served as a Reviewer of the Academic Accreditation Policy Book 2021 for Saudi Arabia, 2021.

- Received two **Certificate of Appreciation Awards** from the IEEE SEM Section for significant contributions to the Spring Section Conference, May 2, 2019.

- Served as **Chair** of the ACM SIGMM Workshop on Network and Operating Systems Support for Digital Audio and Video (NOSSDAV), 2018.

- Received **Certificate of Appreciation Award** from the IEEE SEM Section for dedicated leadership and significant contribution to the IEEE SEM Humanitarian Technology Conference and to the success of IEEE SEM activities, July 9, 2016.

- Served as **General Chair** of the Fifth IEEE International Workshop on Quality of Experience for Multimedia Communications (QoEMC 2016), Washington, DC USA, December 8, 2016.

- Received **Certificate of Appreciation Award** from the IEEE SEM Section for being an invited speaker and for outstanding contribution to the success of the IEEE SEM Section Spring 2015 Conference, April 28, 2015.

- Served as the **Chair of the Interest Group on Media Streaming**, IEEE Multimedia Communication Technical Committee, 2012 - 2014.

- Served as **Associate Editor** of the IEEE Transactions on Circuits and Systems for Video Technology, 2012-2015.

- Served as the **Guest Editor** for Multimedia, IEEE COMSOC MMTC E-Letter, Special Issue on Cloud Computing, Vol. 8, No. 6, November 2013.

- Served as a **Guest Editor** for Multimedia Tools and Applications Journal, Special Issue on Real-time Multimedia Computing, 65(2), July 2013.

- Served as **Chair** of the Multimedia Computing and Communications (MCC) Symposium, 2015.

- Served as **Co-Chair** of the Technical Program Committee of the International Conference on Computing, Networking and Communication (ICNC 2014), 2014

- Served as **Chair** of the Green Computing, Networking, and Communications Symposium (GCNC), 2014.

- Has a published paper that was nominated for the Best Paper Award at the IEEE International Conference on Multimedia and Expo (ICME 2013). (ICME is a premier conference with an acceptance rate of 12.7% for regular papers.)

- Served as **Co-Director** of the IEEE Multimedia Communication Technical Committee Review Board, 2010 - 2012.

- Served as an Expert Witness/Consulting Expert in several patent infringement cases related to video streaming, involving major cellular networks, mobile operating systems makes, smartphone manufacturers, and media streaming companies, 2012-Current.

- Received the 2009 **President's Award for Excellence in Teaching**, Wayne State University, April 28, 2009.

Page **7** of **40**

- Received The 2008 **Outstanding Professional Award** from the Institute of Electrical and Electronics Engineers (IEEE) Southeastern Michigan Section for many accomplishments in multimedia computing and networking research and university teaching profession, March 2008 (at Engineering Society of Detroit Banquet) and April 2008 (at IEEE-SEM Spring Conference).

- Received The 2007 College of Engineering **Excellence in Teaching Award**, College of Engineering, Wayne State University, April 2008.

- Received 2007-2008 Wayne State University **Research Award**, March 2008.

- Served as the Faculty Counselor of the Institute of Electrical and Electronics Engineers (IEEE) Wayne State University Student Branch, which

   o Won The 2011 Michael Darson Award for Most Outstanding Student Organization.
   o Won the 2010 Michael Darson Award for Most Outstanding Student Organization.
   o Won The 2009 IEEE Southeastern Michigan Outstanding Student Branch Award, April 2009.
   o Won The 2008 IEEE Southeastern Michigan Outstanding Student Branch Award, April 2008.
   o Received Special Recognition Certificate from IEEE-USA for outstanding service, leadership, and commitment to IEEE-USA and the Profession.
   o Received two Recognition Certificates from IEEE Southeastern Michigan Section (2008 and 2009).
   o Was nominated for the 2007 IEEE Southeastern Michigan Outstanding Student Branch Award.
   o Was selected as the host and organizer of the 2008 IEEE-USA Student Professional Awareness Workshop on October 18, 2008: Many national IEEE leaders and more than 70 students from 5 universities participated in this workshop.
   o Had an officer who received the 2007 IEEE Southeastern Michigan Outstanding Student Involvement Award.
   o Won third place in the IEEE Region 4 Ethics Contest, November 2007.

- Received a **Certificate of Appreciation Award** from the Institute of Electrical and Electronics Engineers Southeastern Michigan Section for outstanding contribution as an invited speaker at the Spring 2008 Section Conference, April 2008.

- Received the **Computer Science and Engineering Graduate Student Teaching Award**, Computer Science and Engineering Department, Pennsylvania State University, University Park, March 2001.

- Served as the president of a Penn State student organization for two years.

- Was named to Marquis Who's Who Emerging Leaders, Who's Who in Science and Engineering, and Who's Who in America.

Educational Background

- Ph.D., Computer Science and Engineering, Pennsylvania State University, University Park, GPA = 4.0 / 4.0, August 2003.

- M.S., Computer Science and Engineering, Pennsylvania State University, University Park, GPA = 4.0 / 4.0, May 2003.

- B.S., Electrical Engineering with Computer Engineering specialization, Jordan University of Science and Technology, Jordan, September 1995.

Research Areas of Interest

Computer systems design, multimedia systems, video streaming, computer networking, data communication, deep learning, hardware accelerators for AI, computer vision systems, automated video surveillance, I/O

Research Grants/Awards

- National Science Foundation, EPCN-Energy-Power-Ctrl-Netwrks: "An Energy-Efficient, CMOS-based, and Scalable Mixed-Signal DNN System with Reconfigurable Crossbars", As Co-PI with Mohammad Alhawari, September 2022 – August 2025, $418,907.

- Silicon Mechanics, Third Annual Research Cluster Grant: "Silicon Mechanics Research Cluster Grant", as Co-PI with Loren Schwiebert et al., March 2014, Equipment Grant for a high-performance computing cluster, valued at about $190,000.

- National Science Foundation, Computer Systems Research (CSR) Program, "DMSS: Towards Resource-Efficient Automated Video Surveillance Systems", As PI and Sole Investigator, September 2008 - August 2014, $290,000. (Only 10-15% of proposals were

accepted.)

- National Science Foundation, Networking Technology and Systems (NeTS) Program, "NBD: Efficient Delivery of Video-on-Demand Streams to Heterogeneous Receivers", as PI and Sole Investigator, September 2006 - August 2008, $180,887, (Only 10% out of 274 proposals were accepted).

- National Science Foundation, Computing Research Infrastructure (CRI), "CRI: Reconfigurable High Performance Cluster Computing and Medical Engineering Applications", as Co-PI with Cheng-Zhong Xu, September 2007 - August 2009, $200,445.

- Sun Microsystems, "Sun's Center of Excellence in Open Source Computing and Applications", Equipment Grant of cluster of 8 servers with a total of 40 cores, As Co-PI with Cheng-Zhong Xu and S. Jiang, January 2009 - December 2010, valued at $150,000.

- Sun Microsystems, "Integration of Sun Technologies in Wayne State Classes", Equipment Grant, March 2008, As Co-PI with Cheng-Zhong Xu, Approximate Value: $50,000.

- National Science Foundation, Networking Technology and Systems (NeTS) Program, REU Supplement, "NBD: Efficient Delivery of Video-on-Demand Streams to Heterogeneous Receivers", As PI and Sole Investigator, June 2008 - August 2008, $12,000.

- National Science Foundation, "REU Site Telematics and Automotive Information Technology", As Faculty Mentor, with Cheng-Zhong Xu, 2009-2010, $314,500. (As mentor)

- Wayne State University Research Award, "Towards Resource-Efficient Automated Video Surveillance", As PI and Sole Investigator, April 2008, $10,000.

Patents

- Nabil. J. Sarhan. US Patent 9,313,463: "Automated Video Surveillance Systems", April 12, 2016.

- Hamza Al-Maharmeh, Mohammad Alhawari, Nabil Sarhan, and Mohammed Ismail Elnaggar. Energy Efficient Digital to Time Converter (DTC) for Edge Computing (Provisional Patent Application).

Editorships

- NOSSDAV '18: Proceedings of the 28th ACM SIGMM Workshop on Network and Operating Systems Support for Digital Audio and Video, Association for Computing Machinery, Amsterdam, Netherlands, June 12-15, 2018, ISBN: 978-1-4503-5772-2. Link. (As Program Chair)

- Special Issue on Cloud Computing for Multimedia, *IEEE COMSOC MMTC E-Letter*, Vol. 8, No. 6, November 2013. (As Guest Editor)

- Special Issue on Real-time Multimedia Computing, *Multimedia Tools and Applications Journal*, 65(2), July 2013. (As Guest Editor with SooKyun Kim, Henry Duh, and Vladimir Hahanov). DOI: https://doi.org/10.1007/s11042-013-1428-6. Journal metrics: Impact factor: 2.577 (2021).

- Proceedings of the 15th International Conference on Internet and Multimedia Systems and Applications, May 16 – 18, 2011, Washington, DC, USA, ISBN 978-88986-871-7. (As the Editor).

- IEEE Computer Society Multimedia Communications Technical Committee R-Letter, Vol. 3, No 3, June 2012. (As Co-Director of the Editorial Board)

- IEEE Computer Society Multimedia Communications Technical Committee R-Letter, Vol. 3, No 2, April 2012. (As Co-Director of the Editorial Board)

- IEEE Computer Society Multimedia Communications Technical Committee R-Letter, Vol. 3, No 1, February 2012. (As Co-Director of the Editorial Board)

- IEEE Computer Society Multimedia Communications Technical Committee R-Letter, Vol. 2, No 6, December 2011. (As Co-Director of the Editorial Board)

- IEEE Computer Society Multimedia Communications Technical Committee R-Letter, Vol. 2, No 5, October 2011. (As Co-Director of the Editorial Board)

- IEEE Computer Society Multimedia Communications Technical Committee R-Letter, Vol. 2, No 4, August 2011. (As Co-Director of the Editorial Board)

- IEEE Computer Society Multimedia Communications Technical Committee R-Letter, Vol. 2, No 3, June 2011. (As Co-Director of the Editorial Board)

- IEEE Computer Society Multimedia Communications Technical Committee R-Letter, Vol. 2, No 2, April 2011. (As Co-Director of the Editorial Board)

- [IEEE Computer Society Multimedia Communications Technical Committee R-Letter](), Vol. 2, No 1, February 2011. (As Co-Director of the Editorial Board)

- IEEE Computer Society Multimedia Communications Technical Committee R-Letter, Vol. 1, No 2, December 2010. (As Co-Director Editorial Board)

- IEEE Computer Society Multimedia Communications Technical Committee R-Letter, Vol. 1, No 1, October 2010. (As Co-Director Editorial Board)

Book Chapters

- Nabil. J. Sarhan. [Multimedia Streaming](). In *Handbook of Computer Networks*, Editor: Hossein Bidgoli, pp. 282-292, John Wiley & Sons, Inc., 23 November 2007. Print ISBN:9780471784593, Online ISBN: 9781118256114. DOI: [https://doi.org/10.1002/9781118256053.ch17]().

Selected Referred Papers

> Note: In computer engineering and science, premier conference publications are as important, if not more important than premier journal publications.

- Sina G. Davani and Nabil J. Sarhan. Experimental Analysis of Optimal Bandwidth Allocation in Computer Vision Systems. *IEEE Transactions on Circuits and Systems for Video Technology*, Volume: 31, Issue: 10, October 2021. DOI: [10.1109/TCSVT.2020.3044015]().

- Sina G. Davani, Musab Al-Hadrusi, and Nabil J. Sarhan. An Autonomous System for Efficient Control of PTZ Cameras. *ACM Transactions on Autonomous and Adaptive Systems*, Volume 16, Issue 2, June 2021, Article No.: 6, pp 1-22. DOI: [https://doi.org/10.1145/3507658]().

- Yousef O. Sharrab, Izzat Alsmadi, and Nabil J. Sarhan. Towards the Availability of Video Communication in Artificial Intelligence-based Computer Vision Systems Utilizing a Multi-objective Function. *Cluster Computing*, Springer, August 2021. DOI: [https://doi.org/10.1007/s10586-021-03391-4]().

- Ian McNulty, Shiva Maleki Varnosfaderani, Omar Makke, Nabil J. Sarhan, Eishi Asano, Aimee Luat, and Mohammad Alhawari. Analysis of Artifacts Removal Techniques in EEG Signals for Energy-Constrained Devices. In Proceedings of the *IEEE International*

Midwest Symposium on Circuits and Systems (MWSCAS), August 2021.
DOI: 10.1109/MWSCAS47672.2021.9531909.

- Shiva M. Varnosfaderani, Rihat Rahman, Nabil J. Sarhan, Levin Kuhlmann, Eishi Asano, and Mohammad Alhawari. A Two-Layer LSTM Deep Learning Model for Epileptic Seizure Prediction. In Proceedings of the 3rd *IEEE International Conference on Artificial Intelligence Circuits & Systems* (AICAS 2021), June 2021.
DOI: 10.1109/AICAS51828.2021.9458539.

- Hamza Al Maharmeh, Nabil J. Sarhan, Chung-Chih Hung, Mohammed Ismail, and Mohammad Alhawari. A Comparative Analysis of Time-Domain and Digital-Domain Hardware Accelerators for Neural Networks. In Proceedings of the *IEEE International Symposium on Circuits and Systems* (ISCAS), May 2021.
DOI: 10.1109/ISCAS51556.2021.9401758.

- Rihat Rahman, Shiva Varnosfaderani, Omar Makke, Nabil Sarhan, Eishi Asano, Aimee Luat, and Mohammad Alhawari. Comprehensive Analysis of EEG Datasets for Epileptic Seizure Prediction. In Proceedings of the *IEEE International Symposium on Circuits and Systems* (ISCAS), May 2021. DOI: 10.1109/ISCAS51556.2021.9401766.

- Mohammad A. Alsmirat and Nabil J. Sarhan. Intelligent Optimization for Automated Video Surveillance at the Edge: A Cross-Layer Approach. *Simulation Modelling Practice and Theory*, Elsevier, Volume 105, 102171, December 2020. DOI: https://doi.org/10.1016/j.simpat.2020.102171.

- Hayder Hamandi and Nabil J. Sarhan. Novel Analytical Models of Face Recognition Accuracy in Terms of Video Capturing and Encoding Parameters. In Proceedings of the *IEEE International Conference on Multimedia and Expo* (ICME 2020), London, United Kingdom, July 2020, pp. 1-6. DOI: 10.1109/ICME46284.2020.9102791.

- Hamza Al Maharmeh, Nabil J. Sarhan, Chung-Chih Hung, Mohammed Ismail, Mohammad Alhawari. Compute-in-Time for Deep Neural Network Accelerators: Challenges and Prospects. Proceedings of the IEEE 63rd *International Midwest Symposium on Circuits & Systems* (MWSCAS 2020), pages 990-993, August 9-12, 2020. DOI: 10.1109/MWSCAS48704.2020.9184470.

- Melvin D. Edwards, Hamza Al Maharmeh, Nabil J. Sarhan, Mohammed Ismail, and Mohammad Alhawari. A Low-Power, Digitally-Controlled, Multi-Stable, CMOS Analog Memory Circuit. Proceedings of the IEEE 63rd *International Midwest Symposium on*

Circuits & Systems (MWSCAS 2020), pages 872-875, August 9-12, 2020.
DOI: 10.1109/MWSCAS48704.2020.9184459.

- Mohammad A. Alsmirat and Nabil J. Sarhan. Cross-Layer Optimization for Many-to-One Wireless Video Streaming Systems. *Multimedia Tools and Applications*, Volume 77, Number 4, pages 1 - 23, Springer US, February 2018. DOI: 10.1007/s11042-018-5698-x.

- Sina G. Davani and Nabil J. Sarhan. Experimental Analysis of Bandwidth Allocation in Automated Video Surveillance Systems. In Proceedings of the 2017 *ACM Conference on Multimedia* (MM '17), pages 1457-1464, Mountain View, California, USA, October 2017. DOI: https://doi.org/10.1145/3123266.3123376. Best venue in the multimedia area.

- Yousef O. Sharrab and Nabil J. Sarhan. Modeling and Analysis of Power Consumption in Live Video Streaming Systems. *ACM Transactions on Multimedia Computing Communications and Applications* (ACM TOMM). Volume 13, Issue 4, pages 54:1-54:25, September 2017. DOI: https://doi.org/10.1145/3115505.

- Musab Al-Hadrusi, Nabil J. Sarhan, and Sina G. Davani. A Clustering Approach for Controlling PTZ Cameras in Automated Video Surveillance. In Proceedings of the *IEEE International Symposium on Multimedia* (ISM 2016), pages 333-336, San Jose, CA, USA, December 2016. DOI: 10.1109/ISM.2016.0073.

- Mohammad Alsmirat and Nabil J. Sarhan. Cross-Layer Optimization for Automated Video Surveillance. In Proceedings of the *IEEE International Symposium on Multimedia* (ISM 2016) pages 243-246, San Jose, CA, USA, December 2016.
DOI: 10.1109/ISM.2016.0055.

- Kamal Nayfeh and Nabil J. Sarhan. A Scalable Solution for Interactive Near Video-on-Demand Systems. *IEEE Transactions on Circuits and Systems for Video Technology*, Volume 26, Number 10, pages 1907 - 1916, October 2016.   DOI: 10.1109/TCSVT.2015.2478708.

- Kamal Nayfeh and Nabil J. Sarhan. Client-Side Cache Management for Scalable and Interactive Video Streaming. *IEEE International Conference on Multimedia and Expo* (ICME 2016), pages 1-6, Seattle, WA, 2016. DOI: 10.1109/ICME.2016.7552967.

- Musab Al-Hadrusi and Nabil J. Sarhan. A Scalable Delivery Solution and a Pricing Model for Commercial Video-on-Demand Systems with Video Advertisements. *Multimedia*

Tools and Applications, Volume 73, Issue 3, pp 1417-1443, Springer US, December 2014. DOI: https://doi.org/10.1007/s11042-013-1597-3.

- Kamal Nayfeh and Nabil J. Sarhan. Design and Analysis of Scalable and Interactive Near Video-on-Demand Systems. In Proceedings of the *IEEE International Conference on Multimedia and Expo*, San Jose, California, July 2013. DOI: 10.1109/ICME.2013.6607540. Best Paper candidate. One of the best venues in multimedia. Acceptance rate for regular papers (with oral presentations): 12.7% (79 accepted out of 622 papers).

- Yousef Sharrab and Nabil J. Sarhan. Aggregate Power Consumption Modeling of Live Video Streaming Systems. In Proceedings of the *ACM Multimedia Systems* (MMSys 2013), Oslo, Norway, February 27 - March 1, 2013. DOI: https://doi.org/10.1145/2483977.2483983. Among the best venues in the multimedia area. Acceptance rate: 23.8%.

- Yousef Sharrab and Nabil J. Sarhan. Detailed Comparative Analysis of VP8 and H.264. In Proceedings of the *IEEE International Symposium on Multimedia* (ISM 2012), Irvine, California, December 2012. DOI: 10.1109/ISM.2012.33. Among the best venues in the multimedia area. Acceptance rate: 24.8%.

- Musab Al-Hadrusi and Nabil J. Sarhan. Efficient Control of PTZ Cameras in Automated Video Surveillance Systems. In Proceedings of the *IEEE International Symposium on Multimedia* (ISM 2012), Short Paper, Irvine, California, December 2012. DOI: https://doi.org/10.1109/ISM.2012.72.

- Mohammad Alsmirat and Nabil J. Sarhan. Cross-Layer Optimization and Effective Airtime Estimation for Wireless Video Streaming. In Proceedings of the *International Conference on Computer Communications and Networks* (ICCCN 2012), pages 1 – 7, Munich, Germany, July 2012. DOI: 10.1109/ICCCN.2012.6289275. Acceptance rate: 30%.

- Yousef Sharrab and Nabil J. Sarhan. Accuracy and Power Consumption Tradeoffs in Video Rate Adaptation for Computer Vision Applications. In Proceedings of the 2012 *IEEE International Conference on Multimedia & Expo* (ICME 2012), pages 410 - 415, Melbourne, Australia, July 2012. DOI: https://doi.org/10.1109/ICME.2012.77.

- Musab Al-Hadrusi and Nabil J. Sarhan. Client-Driven Price Selection for Scalable Video Streaming with Advertisements. In *Proceedings of the International MultiMedia Modeling Conference* (MMM 2012), pages 429 - 439, Klagenfurt, Austria, January 2012. DOI: https://doi.org/10.1007/978-3-642-27355-1_40. Acceptance rate: 34.9%.

- Nabil J. Sarhan and Musab Al-Hadrusi. Waiting-Time Prediction and QoS-Based Pricing for Video Streaming with Advertisements. In Proceedings of the *IEEE International Symposium on Multimedia* (ISM 2010), pages 17 - 24, Taichung, Taiwan, December 2010. DOI: https://doi.org/10.1109/ISM.2010.13. Acceptance rate: 31%.

- Bashar Qudah and Nabil J. Sarhan. Efficient Delivery of On-Demand Video Streams to Heterogeneous Receivers. *ACM Transactions on Multimedia Computing, Communications, and Applications* (ACM TOMCCAP), Volume 6, Issue 3, August 2010. DOI: https://doi.org/10.1145/1823746.1823754.

- Nabil J. Sarhan, Mohammad A. Alsmirat, and Musab Al-Hadrusi. Waiting-Time Prediction in Scalable On-Demand Video Streaming. *ACM Transactions on Multimedia Computing, Communications, and Applications* (ACM TOMCCAP), Volume 6, Issue 2, March 2010. DOI: https://doi.org/10.1145/1671962.1671967.

- Mohammad Alsmirat and Nabil J. Sarhan. Detailed Performance and Waiting-Time Predictability Analysis of Scheduling Options in On-Demand Video Streaming. *EURASIP Journal on Image and Video Processing*, Springer, Volume 2010, 2010.

- Bashar Qudah and Nabil J. Sarhan. Workload-Aware Resource Sharing and Cache Management for Scalable Video Streaming. *IEEE Transactions on Circuits and Systems for Video Technology*, Vol. 19, No. 3, March 2009. DOI: 10.1109/TCSVT.2009.2013498,

- Mohammad Alsmirat and Nabil J. Sarhan. Performance and Waiting-Time Predictability Analysis of Design Options in Cost-Based Scheduling for Scalable Media Streaming. In *Proceedings of the International MultiMedia Modeling Conference* (MMM 2009), pages 150-162, Sophia-Antipolis, France, January 2009. DOI: https://doi.org/10.1007/978-3-540-92892-8_16. Accepted for oral-style presentation (as opposed to poster). Acceptance rate for oral presentations: 16%.

- Jeffrey R. Ostrowski and Nabil J. Sarhan. Characterization of Social Video. In *Proceedings of SPIE Multimedia Computing and Networking* (MMCN), San Jose, California, USA, January 2009. DOI: 10.1117/12.815535. Acceptance rate: 35%.

- Musab Al-Hadrusi and Nabil J. Sarhan. A Scalable Delivery Framework and a Pricing Model for Streaming Media with Advertisements. In *Proceedings of SPIE Multimedia Computing and Networking* (MMCN 2008), pages 68180G-68180G, San Jose, California, USA, January/February 2008. DOI: https://doi.org/10.1145/1291233.1291412. Acceptance rate for full-length papers: 26%.

- Mohammad Alsmirat and Nabil J. Sarhan. Predictive Cost-Based Scheduling for Scalable Video Streaming. In *Proceedings of the IEEE International Conference on Multimedia & Expo* (ICME 2008), pages 857 - 860, Hannover, Germany, June 2008. DOI: 10.1109/ICME.2008.4607570. Accepted as oral-style presentation (as opposed to poster). Acceptance rate for oral presentations: 20%.

- Mohammad Alsmirat, Musab Al-Hadrusi, and Nabil J. Sarhan. Analysis of Waiting-Time Predictability in Scalable Media Streaming. In *Proceedings of ACM Multimedia*, pages 727 - 736, Augsburg, Germany, September 2007. DOI: https://doi.org/10.1145/1291233.1291398. Best venue of publication in the multimedia area. Acceptance Rate: 19%.

- Musab Al-Hadrusi and Nabil J. Sarhan. Scalable Delivery and Pricing of Streaming Media with Advertisements. In *Proceedings of ACM Multimedia*, pages 791 - 794, Augsburg, Germany, September 2007. Best venue of publication in the multimedia area. Acceptance Rate: 27%.

- Nabil J. Sarhan and Bashar Qudah. Efficient Cost-Based Scheduling for Scalable Media Streaming. In *Proceedings of the SPIE/ACM Multimedia Computing and Networking Conference* (MMCN 2007), pages 65040C-65040C, San Jose, California, USA, January/February 2007.   DOI: 10.1117/12.706022.Acceptance Rate: 30%.

- Bashar Qudah and Nabil J. Sarhan. Towards Enhanced Resource Sharing in Video Streaming with Generalized Access Patterns. In *Proceedings of the IEEE International Conference on Multimedia & Expo* (ICME 2007), pages 1219 - 1222, Beijing, China, July 2007. DOI: 10.1109/ICME.2007.4284876.

- Bashar Qudah and Nabil J. Sarhan. Towards Scalable Delivery of Video Streams to Heterogeneous Receivers. In *Proceedings of ACM Multimedia*, pages 347 - 356, Santa Barbra, California, USA, October 2006. DOI: 10.1145/1180639.1180716. Best venue in the multimedia area. Acceptance Rate: 16%.

- Bashar Qudah and Nabil J. Sarhan. Analysis of Resource Sharing and Cache Management Techniques in Scalable Video-on-Demand. In *Proceedings of the 14th IEEE International Symposium on Modeling, Analysis, and Simulation of Computer and Telecommunication Systems* (MASCOTS 2006), pages 327 – 334, Monterey, California, USA, September 2006. DOI: https://doi.org/10.1109/MASCOTS.2006.13. Acceptance Rate: 36%.

- Nabil J. Sarhan and Chita R. Das. Caching and Scheduling in NAD-Based Multimedia Servers. *IEEE Transactions on Parallel and Distributed Systems*, Vol. 15, No. 10, pages 921 - 933, October 2004. DOI: 10.1109/TPDS.2004.49.

- Nabil J. Sarhan and Chita R. Das. A New Class of Scheduling Policies for Providing Time of Service Guarantees in Video-On-Demand Servers. In *Proceedings of the 7th IFIP/IEEE International Conference on Management of Multimedia Networks and Services*, (MMNS 2004), pages 127 - 139, San Diego, California, USA, October 2004. DOI: 10.1007/978-3-540-30189-9_11. Acceptance Rate: 31%.

- Nabil J. Sarhan and Chita R. Das. Analysis of Caching Performance in Multimedia Servers. In *Proceedings of the 8th International Conference on Internet and Multimedia Systems and Applications*, pages 288 - 293, Hawaii, USA, August 2004. Acceptance rate: NA.

- Nabil J. Sarhan and Chita R. Das. An Integrated Resource Sharing Policy for Multimedia Storage Servers Based on Network-Attached Disks. In *Proceedings of the 23rd IEEE International Conference on Distributed Computing Systems* (ICDCS 2003), pages 136 - 143, Providence, Rhode Island, USA, May 2003. DOI: 10.1109/ICDCS.2003.1203460. Best venue in the distributed systems area. Acceptance Rate: 17%.

- Nabil J. Sarhan and Chita R. Das. Providing Time of Service Guarantees in Video-On-Demand Servers. In Poster *Proceedings of the Twelfth International World Wide Web Conference* (WWW 2003), Budapest, Hungary, May 2003. WWW is the best conference in the Web area.

- Nabil J. Sarhan and Chita R. Das. A Simulation-Based Analysis of Scheduling Policies for Multimedia Servers. In *Proceedings of the 36th Annual Simulation Symposium* (ANSS 2003), pages 183 - 190, Orlando, Florida, USA, March 30 - April 2, 2003. DOI: 10.1109/SIMSYM.2003.1192812. Acceptance Rate: 39%.

- Nabil J. Sarhan and Chita R. Das. Adaptive Block Rearrangement Algorithms for Video-On-Demand Servers. In *Proceedings of the 2001 International Conference on Parallel Processing* (ICPP 2001), pages 452 - 459, Valencia, Spain, September 2001. DOI: 10.1109/ICPP.2001.952092.

Magazine Articles

- Nabil. J. Sarhan. Is 3D Here to Stay? Analysis of 3D Video Projection Technologies. *ESD Technology Century*, Vol. 15 No. 3, Fall 2010.

- Nabil. J. Sarhan. Do You ... YouTube? YouTube and the Technology Behind It. *ESD Technology Century*, Vol. 14, No. 2, April-May 2009. (Featured as the main article on the cover page.)

Invited Articles

- Nabil. J. Sarhan. Recent and Future Trends in Mobile Video Streaming. *IEEE Computer Society Multimedia Communications Technical Committee e-Letter*, Special Issue on Multimedia Streaming over Mobile Networks, Vol. 8, No. 5, September 2013.

- Nabil. J. Sarhan. Broadcast and Multicast Based Mobile Video Distribution. *IEEE Computer Society Multimedia Communications Technical Committee e-Letter*, Vol. 4, No. 8, September 2009.

Invited Panels

- Panelist, "Automated Wayne State Video Surveillance (WAVS) System", IEEE SEM Humanitarian Technology Conference, July 9, 2016.

- Panelist, "Challenges and Applications of Mobile Video Technologies", ACM Workshop on Mobile Video (MoVid), Oslo, Norway, February 2013.

- Panelist, "Content Distribution (P2P versus Infrastructure) and the Mobil Age", SPIE/ACM Multimedia Computing and Networking (MMCN), San Jose, California, USA, January 2008.

Selected Technical Presentations

- "Analysis of Deep Learning Accuracy". IEEE SEM Spring Section Conference, May 2, 2019.

- "Towards Energy Adapted Video Streaming". IEEE SEM Spring Section Conference, May 2, 2019.

- "Dependency-aware Scheduling for Tasks with Constraints in Big Data Clusters". The 6th Annual Big Data & Business Analytics Summit, March 22, 2019 (Poster).

- "Experimental Analysis of Bandwidth Allocation in Automated Video Surveillance Systems", ACM Multimedia, October 2017

- "A Clustering Approach for Controlling PTZ Cameras in Automated Video Surveillance". IEEE International Symposium on Multimedia (ISM 2016), San Jose, December 2016.

- "Cross-Layer Optimization for Automated Video Surveillance". IEEE International Symposium on Multimedia (ISM 2016), San Jose, December 2016.

- "Design and Analysis of Scalable and Interactive Near Video-on-Demand Systems". IEEE International Conference on Multimedia and Expo, San Jose, California, July 2013.

- "Aggregate Power Consumption Modeling of Live Video Streaming Systems". ACM Multimedia Systems (MMSys 2013), Oslo, Norway, February 27 - March 1, 2013.

- "Efficient Control of PTZ Cameras in Automated Video Surveillance Systems". IEEE International Symposium on Multimedia (ISM 2012), Irvine, California, December 11, 2012.

- "Detailed Comparative Analysis of VP8 and H.264". IEEE International Symposium on Multimedia (ISM 2012), Irvine, California, December 12, 2012 (presented by my student).

- "Cross-Layer Optimization and Effective Airtime Estimation for Wireless Video Streaming". International Conference on Computer Communications and Networks (ICCCN 2012), Munich, Germany, July 2012.

- "Client-Driven Price Selection for Scalable Video Streaming with Advertisements". International MultiMedia Modeling Conference (MMM 2012), Klagenfurt, Austria, January 2012.

- "Vehicular Multimedia and Communication Systems: Recent and Future Trends". International Conference on Advanced Research & Applications in Mechanical Engineering (ICARAME 2011), Louaize, Lebanon, June 13, 2011.

- "Waiting-Time Prediction and QoS-Based Pricing for Video Streaming with Advertisements". IEEE International Symposium on Multimedia (ISM 2010), Taichung, Taiwan, December 13, 2010. (Video Presentation)

- "Characterization of Social Video". SPIE Multimedia Computing and Networking (MMCN), San Jose, California, USA, January 19, 2009.

- "Alternative Pricing and Scalable Delivery Strategies for Media Streaming with Advertisements". Workshop on Hot Topics in Multimedia Research, Darmsdat, Germany, June 21, 2008.

- "Predictive Cost-Based Scheduling for Scalable Video Streaming". IEEE International Conference on Multimedia & Expo (ICME 2008), Hannover, Germany, June 25, 2008.

- "A Scalable Delivery Framework and a Pricing Model for Streaming Media with Advertisements". SPIE/ACM Multimedia Computing and Networking (MMCN 2008), San Jose, California, USA, January 31, 2008.

- "Analysis of Waiting-Time Predictability in Scalable Media Streaming". ACM Multimedia, Augsburg, Germany, September 2007.

- "Efficient Cost-Based Scheduling for Scalable Media Streaming". SPIE/ACM Multimedia Computing and Networking Conference (MMCN 2007), San Jose, California, USA, February 1, 2007.

- "A New Class of Scheduling Policies for Providing Time of Service Guarantees in Video-On-Demand Servers". International Conference on Management of Multimedia Networks and Services (MMNS), San Diego, California, October 5, 2004.

- "An Integrated Resource Sharing Policy for Multimedia Storage Servers Based on Network-Attached Disks". International Conference on Distributed Computing Systems (ICDCS 2003), Providence, Rhode Island, May 20, 2003.

- "On the Design of Scalable and High Performance Multimedia Servers", University of Arkansas, Little Rock, May 15, 2003.

- "A Simulation-Based Analysis of Scheduling Policies for Multimedia Servers'. Annual Simulation Symposium (ANSS 2003), Orlando, Florida, April 1, 2003.

- "Multimedia Systems and Networking: Challenges, Studies, and Future Work", ECE Seminar, Wayne State University, Detroit, Michigan, February 11, 2004.

Invited Talks

- School Presentation, "Demystifying Artificial Intelligence for Kids: How to teach computers how to do things?", STEM Night, IIA School, Detroit, MI, Sept. 26, 2019.

- "Towards Highly Scalable and Interactive Video Streaming Systems", IEEE SEM Spring Conference, University of Michigan – Dearborn, April 28, 2015.

- "Outstanding IEEE Professional Presentation: Scalable Delivery and Pricing for Streaming Media with Advertisements", IEEE Southeastern Michigan Conference (IEEE-SEM),

University of Michigan, Dearborn, USA, April 2, 2008.

- "Graduate School: Is It Right for You", IEEE End of School Year Event, University of Michigan, Dearborn, USA, May 4, 2008.

Tutorials

- Nabil. J. Sarhan. Video Streaming over the Internet and Wireless Networks: Challenges and Approaches, International Conference on Information and Communication Systems, Amman, Jordan, December 20-22, 2009.

Conference Exhibitions

- Wayne State Automated Video Surveillance System, MiSN Homeland Security Market Leadership Conference, Dearborn, Michigan, November 4, 2009.

Educational Activities

- Serving as the **Overall Coordinator** of the College of Engineering M.S. Program in Artificial Intelligence and the **Director** of Systems and Hardware Track, since August 2022.

- Led the college efforts to develop the **College of Engineering M.S. Program in Artificial Intelligence**, 2021-2022.

- Serving as the **Chair of the Computer Engineering Area Committee,** which made significant improvements in the computer engineering curricula at both the graduate and undergraduate levels, 2017 – current.

- Developed a new ECE mandatory course titled "Object-Oriented Programming for Electrical and Computer Engineering (ECE 2050)".

- Led the efforts to modernize the Introduction to Microcomputers course and lab (the ECE 3620) by using ARM-based microcontrollers, 2020 - 2021.

- Served as the **Director of the ECE Graduate Program**, 2011 – 2013 and made the following contributions.

  o Developing a new graduate curriculum for the M.S. degrees in Electrical Engineering and Computer Engineering,

- o Developing several new policies for admission, plagiarism, overrides, grade performance requirements, form submission, Ph.D. prerequisite requirements, and Ph.D. Prelim Exam,

- o Substantially revising and enhancing almost all graduate forms for better clarity, level of detail, and formatting,

- o Substantially revising and enhancing the graduate handbook and all other documentation, and

- o Substantially revising and enhancing the graduate website.

- Served as the **Chair of the Computer Engineering Taskforce**, 2014 – 2016, which made significant changes to the Computer Option of the B.S. Degree in Electrical Engineering and the Ph.D. Preliminary Examination requirements and outline for Computer Engineering.

- Developed a research-oriented graduate course on multimedia computing and networking.

- Transformed the senior-level computer architecture course (ECE 4680) into a research and design-oriented course with built-in labs, with the most recent changes in the title and description in May 2019 to reflect new trends in the field.

- Transformed the computer networking course (ECE 5650) into a project-oriented course with built-in labs, with the most recent changes in the title and description in May 2019 to reflect new trends in the field. The course reflects new trends in the field by covering Software-Defined Networking, OpenFlow, and Generalized Forwarding and switching to Python 3. The number of labs is increased from 3 to 5, starting Winter 2020.

- Revised the description and outline of ECE 7650 (Scalable and Secure Internet Services and Architectures", with the most change in the description in May 2019.

Courses Taught

- Advanced Computer Architecture (ECE 7660) at WSU

- Scalable and Secure Internet Services and Architectures (ECE 7650) at WSU

- Special Topics on Multimedia (ECE 7995) at WSU

- Special Topics on Multimedia Networking (ECE 7995) at WSU

- Special Topics on Multimedia Systems and Networks (ECE 7995) at WSU

- Computer Networking and Network Programming (ECE 5650) at WSU

- Computer Architecture (ECE 4680) at WSU

- Data Structures and Algorithms (ECE 4050/CS 5050) at WSU

- Microcomputer Systems and Programming (CSE 312) At Penn State

- Computer Programming for Engineers (CMPSC 201c) at Penn State

- Introduction to Algorithmic Processes (CMPSC 101) at Penn State

Ph.D. Dissertations Supervised

- Hayder Hamandi, "Modeling and Enhancing Deep Learning Accuracy in Computer Vision Applications", Date of defense: July 5, 2022.

- Sina Davani, "Design of Computer Vision Systems for Optimizing the Threat Detection Accuracy", Date of defense: November 16, 2021.

- Hussein M. Khairallah, "Remote Screening and Self-Monitoring for Vision Loss Diseases based on Smartphone Applications", Date of defense: July 23, 2018.

- Yousef Sharrab, "Video Stream Adaptation in Computer Vision Systems", Date of Defense: January 26, 2017.

- Kamal Nayfeh, "A Scalable Solution for Interactive Video Streaming", Date of Defense: November 29, 2016.

- Musab Al-Hadrusi, "Design and Analysis of Scalable Video Streaming Systems", March 18, 2013.

- Mohammad Alsmirat, "Maximizing Resource Utilization in Video Streaming Systems", March 18, 2013.

- Bashar Qudah. "Enhanced Resource Sharing for Scalable Video-on-Demand Services". Date of Defense: January 26, 2009.

M.S. Theses Supervised

- Sina G. Davani, "Towards Optimal PTZ Camera Scheduling in Automated Video Surveillance", Date of defense: December 18, 2017

- Loren Garavaglia, "Analysis of Cross-layer Optimization of Facial Recognition Accuracy in Automated Video Surveillance", Date of defense: August 3, 2017

- Saleh Abdel-Gader Amareen, "Efficient Algorithms for Coding Unit Size Selection in HEVC Using Entropy and Number of Blocks", Date of defense: January 7, 2015

- Jeffrey R. Ostrowski. "Characterization of Social Video". Date of defense: September 15, 2008

Service on External Ph.D. Dissertation Committees

- External Evaluator, Ph.D. Dissertation, Simon Fraser University, Canada, Student Name: Mohammed Shatnawi, "Improving the Reliability of Online Multimedia Communication Services. Date of Defense: November 15, 2018

- External Committee Member, Ph.D. Dissertation, Computer Science, University of Ottawa, Student Name: Atif Alamri, Date of defense: June 30, 2010

Service on Other Ph.D. Dissertation Committees

- Haysam M. Kadry, "Autonomous Spatiotemporal Magnetless Circulators for Full-Duplex Communication", Date of Defense: October 18, 2022.

- Hamza Al-Maharmeh, "Energy-Efficient Mixed-Signal Techniques for Artificial Neural Network Accelerators in Edge Computing", Date of Defense: October 14, 2022.

- Mostafa Daneshgar Rahbar (Electrical and Computer Engineering), Ph.D. Dissertation, Date of Defense: October 16, 2020.

- Guoyao Xu (Electrical and Computer Engineering), Date of Defense: February 8, 2019.

- Nasser Alkhaldi (Electrical and Computer Engineering), Defense: January 24, 2019

- Kun Wang (Electrical and Computer Engineering), Date of defense: November 23, 2015.

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- Yuehai Xu (Electrical and Computer Engineering), Date of defense: August 27, 2014

- Massoud Hassan Alatrash (Electrical and Computer Engineering), Date of defense: October 24, 2013

- Xiangping Bu (Electrical and Computer Engineering), Date of defense: June 25, 2013

- Xuechen Zhang (Electrical and Computer Engineering), Date of defense: August 28, 2012

- Jiayu Gong (Electrical and Computer Engineering), Date of defense: September 1, 2011

- Minghua Xu (Electrical and Computer Engineering), Date of defense: August 30, 2010

- Atif Alamri (Computer Science, University of Ottawa), Date of defense: June 30, 2010

- Nassim Khaled (Mechanical Engineering), Date of defense: June 28, 2010

- Safwan Al-Omari (Computer Science), Date of defense: December 17, 2008

- Mohammed Akkal (Electrical and Computer Engineering), Date of defense: September 4, 2008

- Minghua Xu (Electrical and Computer Engineering), Date of defense: December 6, 2006

- Song Fu (Electrical and Computer Engineering), Date of defense: May 14, 2008

- Haiying Shen (Electrical and Computer Engineering), Date of defense: March 29, 2006

- Jianbin Wei (Electrical and Computer Engineering), Date of defense: July 10, 2006

- Xiliang Zhong (Electrical and Computer Engineering), Date of defense: June 07, 2007

Service on Other M.S. Thesis Committees

- Tareq Dardona (Electrical and Computer Engineering), December 13, 2018

- Jianqiang Ou (Electrical and Computer Engineering), Date of defense: April 6, 2016

- Yudi Xie (Electrical and Computer Engineering), Date of defense: December 14, 2015

- David Wang (Electrical and Computer Engineering), Date of defense: November 3, 2010

- Mumtaz Dawoodi (Electrical and Computer Engineering), Date of defense: February 17, 2010

- Abdurrahman Arif (Electrical and Computer Engineering), Date of defense: January 29, 2009

- Renelius Bell (Electrical and Computer Engineering), Date of defense: November 17, 2008

- Jianbin Wei (Electrical and Computer Engineering), Date of defense: November 24, 2003

- Shixiang Zou (Electrical and Computer Engineering), Date of defense: October 29, 2004

- Abhishek Jindal (Electrical and Computer Engineering), Date of defense: June 30, 2004

Membership of Professional Societies
- **Senior Member**, IEEEE

Professional Activities

Service to Professional Societies

- **Chair, Interest Group on Media Streaming**, IEEE Multimedia Communication Technical Committee, 2012 - 2014.

Editorships

- **Guest Editor**, *Multimedia Tools and Applications Journal*, *Special Issue on Real-time Multimedia Computing*, 65(2), July 2013. (With SooKyun Kim, Henry Duh, and Vladimir Hahanov)

- **Guest Editor**, Special Issue on Cloud Computing for Multimedia, IEEE COMSOC MMTC E-Letter, Vol. 8, No. 6, November 2013.

Editorial Board Memberships

- **Editor**, *ETRI Journal*, 2017 – now.

- **Associate Editor**, *IEEE Transactions on Circuits and Systems for Video Technology*, 2012-2015.

- **Co-Director, IEEE Multimedia Communication Technical Committee Review Board**, 2010 – 2012

- **Associate Editor**, The Journal of Future Game Technology, 2011-2015

Conference Organization

- **Chair**, ACM SIGMM Workshop on Network and Operating Systems Support for Digital Audio and Video (NOSSDAV), 2018.

- **General Chair**, Fifth IEEE International Workshop on Quality of Experience for Multimedia Communications (QoEMC 2016), in conjunction with IEEE Globecom 2016, Washington DC, USA, December 8, 2016

- **Publicity Chair**, Workshop on Quality of Experience-based Management for Future Internet Applications and Services part of IEEE International Conference on Communications (ICC 2016), 2016

- **Chair**, Multimedia Computing and Communications (MCC) Symposium, 2015

- **Publicity Chair**, IEEE Workshop on Quality of Experience-based Management for Future Internet Applications and Services (QoE-FI), part of IEEE International Conference on Communications (IEEE ICC 2015), 2015

- **Co-Chair**, Technical Program Committee, International Conference on Computing, Networking and Communication (ICNC 2014), 2014

- **Chair**, Green Computing, Networking, and Communications Symposium (GCNC 2014), 2014

- **Publicity Chair**, The 2nd International Conference on Intelligent Information System and Technology (ICIIST 2014), 2014

- **Invited Speaker and Panel Co-Chair**, IEEE Globecom 2013 Workshop on Cloud Computing Systems, Networks, and Applications (CCSNA), 2013

- **Publicity Chair**, International Conference on Intelligence Fusion (ICIF2013), 2013

- **Session Chair**, IEEE International Symposium on Multimedia (ISM 2012), 2012

- **Publicity Chair**, International Conference on Computer Convergence Technology (ICCCT 2011), 2012

- **Chair**, 14th International Conference on Internet and Multimedia Systems and Applications (IMSA 2011), 2011

- **Session Chair**, 6th International Conference on Human-Computer Interaction (HCI), 2011

- **Session Chair**, International Conference on Advanced Research & Applications in Mechanical Engineering (ICARAME 2011), 2011.

- **Publicity Chair**, International Conference on Computer Convergence Technology (ICCCT 2011), 2011

- **Track Chair**, Distributed Multimedia Track, International Conference on Embedded and Multimedia Computing (EMC-10), 2010
- **Session Chair**, Multimedia Computing and Networking (MMCN), 2009

- **Session Chair**, SPIE/ACM Multimedia Computing and Networking (MMCN), 2008

- **Session Chair**, IEEE International Conference on Multimedia & Expo (ICME), 2008

- **Session Chair**, International Conference on Internet and Multimedia Systems and Applications (IMSA), 2004

- **Publicity Chair**, International Conference on Intelligence Fusion (ICIF2013), 2013

Service to Funding Agencies

- Proposal Reviewer, Natural Sciences and Engineering Research Council of Canada (NSERC), 2021

- Panelist, National Science Foundation (NSF, IIS Program), USA, 2014

- Panelist, National Science Foundation (NSF, NeTS Program), USA, 2014

- Grant Progress Reviewer, Strategic Network (Large Proposal), Natural Sciences and Engineering Research Council of Canada, Canada, 2013

- Reviewer, The Ontario Centres of Excellence, Canada, 2011

- Site Review Committee Member, Strategic Network (Large Proposal), Natural Sciences and Engineering Research Council of Canada, Canada, 2010

- Panelist, Phase II Contract Proposals, National Institute of Health (NIH)/ National Institute of Alcohol Abuse and Alcoholism (NIAAA), USA 2010

- Panelist, National Science Foundation (NSF), USA, 2010

- Panelist, National Science Foundation (NSF), USA, 2009

- Reviewer, Natural Sciences and Engineering Research Council, Canada, 2009

- Panelist, National Science Foundation (NSF), USA, 2008

- Panelist, Contract Proposals, National Institute of Health (NIH)/ National Institute of Alcohol Abuse and Alcoholism (NIAAA), USA, 2008

- Grant Proposal Reviewer, Kentucky Science and Technology Foundation R&D Excellence Program, USA, 2006

Other Services to Technical Journals and Magazines

- Reviewer, Analog Integrated Circuits and Signal Processing, 2020

- Reviewer, SN Applied Sciences, Springer, 2020

- Reviewer, Transactions on Multimedia Computing, Communications and Applications (ACM TOMM), 2017 (2 papers)

- Reviewer, IEEE Transactions on Mobile Computing, 2017

- Reviewer, IEEE Transactions on Multimedia, 2016

- Reviewer, IEEE Transactions on Parallel and Distributed Systems, 2016

- Reviewer, Transactions on Multimedia Computing, Communications and Applications (ACM TOMM), 2015

- Reviewer, Science China, Information Sciences, 2014

- Reviewer, IEEE Internet Computing, 2014

- Reviewer, Transactions on Multimedia Computing, Communications and Applications (ACM TOMM), 2014

- Reviewer, ACM Transactions on Multimedia Computing Communications and Applications, Special Issue on Multiple Sensorial (MulSeMedia) Multi-modal Media: Advances and Applications, 2013

- Reviewer, IEEE Transactions on Parallel and Distributed Systems, 2013

- Reviewer, IEEE Communications Magazine, 2012

- Reviewer, ACM Transactions on Multimedia Computing Communications and Applications (3 papers), 2012

- Reviewer, IEEE Transactions on Parallel and Distributed Systems (2 papers), 2012

- Reviewer, Multimedia Systems Journal, 2012

- Reviewer, International Journal of Modeling and Simulation, 2012

- Reviewer, ACM Transactions on Multimedia Computing Communications and Applications, 2011

- Reviewer, IEEE Transactions on Parallel and Distributed Systems, 2011 (2 papers)

- Reviewer, Multimedia Systems Journal, 2011

- Reviewer, IEEE/ACM Transactions on Networking, 2010

- Reviewer, ACM Transactions on Multimedia Computing Communications and Applications (3 papers), 2010

- Reviewer, Multimedia Systems Journal, 2010

- Reviewer, Journal of Multimedia, 2010

- Reviewer, IEEE Multimedia Magazine, 2009

- Reviewer, IEEE Transactions on Parallel and Distributed Systems, 2009

- Reviewer, ACM Transactions on Multimedia Computing Communications and Applications (3 papers), 2009
- Reviewer, IEEE/ACM Transactions on Networking, 2009

- Reviewer, Journal of Advanced Media and Communication, 2009

- Reviewer, Elsevier Information Systems, 2009

- Reviewer, ACM Transactions on Multimedia Computing Communications and Applications, 2008

- Reviewer, IEEE Transactions on Parallel and Distributed Systems, 2008

- Reviewer, IEEE Multimedia Magazine, 2007

- Reviewer, IEEE Transactions on Multimedia (2 papers), 2007

- Reviewer, IEEE Transactions on Parallel and Distributed Systems, 2007

- Reviewer, ACM Transactions on Knowledge and Data Engineering, 2007
- Reviewer, ACM Transactions on Multimedia Computing Communications and Applications, 2007 (2 papers)

- Reviewer, IEEE Transactions on Computers (2 papers), 2006

- Reviewer, IEEE Transactions on Parallel and Distributed Systems, 2006

- Reviewer, IEEE Signal Processing Letters, 2006

- Reviewer, IEEE Transactions on Computers, 2005

- Reviewer, IEEE Transactions on Multimedia, 2005

- Reviewer, Journal of Parallel and Distributed Computing (JPDC), 2004

Other Conference Service

- Technical Program Committee Member, ACM Multimedia, 2020

- Technical Program Committee Member, ACM Multimedia, 2019

- Technical Program Committee Member, IEEE International Conference on Multimedia and Expo (ICME), 2019

- Technical Program Committee Member, ACM Multimedia Systems (MMSys), 2018

- Technical Program Committee Member, IEEE International Conference on Multimedia and Expo (ICME), 2018

- Technical Program Committee Member, ACM Multimedia, 2017

- Technical Program Committee Member, IEEE International Conference on Multimedia and Expo (ICME), 2017

- Technical Program Committee Member, ACM Multimedia Systems (MMSys), 2017

- Technical Program Committee Member, ACM SIGMM Workshop on Network and Operating Systems Support for Digital Audio and Video (NOSSDAV), 2017.

- Technical Program Committee Member, ACM Workshop on Mobile Video (MoVid), 2017.

- Technical Program Committee Member, IEEE International Conference on Multimedia & Expo (ICME), 2016

- Technical Program Committee Member, ACM Multimedia, 2016

- Technical Program Committee Member, ACM Multimedia Systems (MMSys), 2016

- Technical Program Committee Member, ACM SIGMM Workshop on Network and Operating Systems Support for Digital Audio and Video (NOSSDAV), 2016

- Technical Program Committee Member, ACM Workshop on Mobile Video (MoVid), 2016.

- Technical Program Committee Member, IEEE Workshop on Quality of Experience-based Management for Future Internet Applications and Services (QoE-FI), part of IEEE International Conference on Communications (IEEE ICC), 2015

- Technical Program Committee Member, ACM Multimedia Systems (MMSys), 2015

- Technical Program Committee Member, IEEE International Conference on Multimedia & Expo (ICME), 2015

- Technical Program Committee Member, ACM SIGMM Workshop on Network and Operating Systems Support for Digital Audio and Video (NOSSDAV), 2015

- Technical Program Committee Member, ACM Workshop on Mobile Video (MoVid), 2015

- Technical Program Committee Member, The International Conference on Digital Telecommunications (ICDT), 2015

- Technical Program Committee Member, IEEE International Conference on Multimedia & Expo (ICME 2014), 2014

- Technical Program Committee Member, ACM Workshop on Mobile Video (MoVid), 2014

- Technical Program Committee Member, ACM Multimedia Systems (MMSys), 2014

- Technical Program Committee Member, The International Conference on Digital Telecommunications (ICDT), 2014

- Panelist, ACM Workshop on Mobile Video (MoVid), 2013

- Technical Program Committee Member, IEEE International Conference on Multimedia & Expo (ICME 2013), 2013

- Technical Program Committee Member, ACM Multimedia Systems (MMSys), 2013

- Technical Program Committee Member, ACM Workshop on Mobile Video (MoVid), 2013

- Technical Program Committee Member, International Conference on Advances in Computing, Communications and Informatics (ICACCI-2013), 2013

- Technical Program Committee Member, The Eighth International Conference on Digital Telecommunications (ICDT 2013), 2013

- Technical Program Committee Member, IEEE International Conference on Multimedia & Expo (ICME 2012), 2012

- Technical Program Committee Member, ACM Multimedia Systems (MMSys), 2012

- Technical Program Committee Member, ACM Workshop on Mobile Video (MoVid'12), 2012

- Technical Program Committee Member, The Seventh International Conference on Digital Telecommunications (ICDT 2012), 2012

- Technical Program Committee Member, ACM Multimedia, 2011

- Technical Program Committee Member, International Workshop on Network and Operating Systems Support for Digital Audio and Video (NOSSDAV 2011), 2011

- Technical Program Committee Member, IEEE International Conference on Multimedia & Expo (ICME 2011), 2011

- Technical Program Committee Member, International Workshop on Pervasive Computing and Multimedia Systems (IEEE-PCMS 2011), 2011

- Technical Program Committee Member, Sixth International Conference on Digital Telecommunications (ICDT 2011), 2011

- Technical Program Committee Member, IEEE Wireless Communications and Networking Conference (IEEE WCNC 2011), 2011

- Technical Program Committee Member, International Workshop on Semantic Computing and Multimedia Systems (IEEE-SCMS), 2010

- Technical Program Committee Member, ACM Multimedia Systems (MMSys), 2011

- Technical Program Committee Member, ACM Multimedia, 2010

- Technical Program Committee Member, International Workshop on Network and Operating Systems Support for Digital Audio and Video (NOSSDAV 2010), 2010

- Technical Program Committee Member, ACM Multimedia Systems (MMSys), 2010

- Technical Program Committee Member, ACM Multimedia, 2009

- Technical Program Committee Member, AfricaIMSA2010, 2010

- Technical Program Committee Member, IEEE Wireless Communications and Networking Conference (IEEE WCNC 2010), 2010

- Technical Program Committee Member, Multimedia Computing and Networking (MMCN), 2009

- Technical Program Committee Member, International Workshop on Semantic Computing and Multimedia Systems (SCMS), 2009

- Technical Program Committee Member, ACM Multimedia, 2008

- Panelist, "Content Distribution (P2P versus Infrastructure) and the Mobil Age", SPIE/ACM Multimedia Computing and Networking (MMCN), 2008

- Technical Program Committee Member, World Wide Web Conference (WWW), 2006

- Technical Program Committee Member, World Wide Web Conference (WWW), 2005

- Technical Program Committee Member, International Conference on Internet and Multimedia Systems and Applications (IMSA), 2009

- Technical Program Committee Member, International Conference on Optical and Wireless Communications (WOC), 2009

- Technical Program Committee Member, International Conference on Distributed and Intelligent Multimedia Systems (DIMS), 2008

- Technical Program Committee Member, International Conference on Optical and Wireless Communications (WOC), 2008

- Technical Program Committee Member, International Conference on Internet and Multimedia Systems and Applications (IMSA), 2008

- Technical Program Committee Member, International Conference on Optical and Wireless Communications (WOC), 2007

- Technical Program Committee Member, International Conference on Internet and Multimedia Systems and Applications (IMSA), 2007

- Technical Program Committee Member, International Workshop on Systems and Network Security (SANS), 2005

- Reviewer, IEEE Wireless Communications and Networking Conference (WCNC), 2007

- Reviewer, IEEE International Symposium on Modeling, Analysis, and Simulation of Computer and Telecommunication Systems (MASCOTS), 2006

- Reviewer, IEEE Wireless Communications and Networking Conference (WCNC), 2005

- Reviewer, International Parallel and Distributed Processing Symposium (IPDPS), 2003

- Reviewer, International Conference on Parallel Processing (ICPP), 2001

Service to External Universities

- External Tenure and Promotion Evaluator, Oakland University, 2020

- External Evaluator, Ph.D. Dissertation, Simon Fraser University, Canada, Student Name: Mohammed Shatnawi, "Improving the Reliability of Online Multimedia Communication Services. Date of Defense: November 15, 2018

- External Reviewer, Faculty Reappointment, Oakland University, 2017

- External Reviewer, Tenure and Promotion Faculty Application, University of Michigan-Dearborn, 2013

- External Ph.D. Dissertation Committee Member, Computer Science, University of Ottawa, Student Name: Atif Alamri, Date of defense: June 30, 2010

Service to Publishers

- Book Reviewer, Thomson Learning, High Holborn House, London, Book Title: "Foundations of Multimedia, by Michael Macaulay", 2007.

- Book Proposal Reviewer, Elsevier, 2015

Service on University Committees

- Member, **WSU Academy of Teachers**, since Fall 2022.

- Member, President's Award for Excellence in Teaching Selection Committee, Winter 2012
- Member, University Educational Development Grant, Winter 2014

- Member, University Academic Senate, Fall 2008 – Winter 2010.

- Member, University Facilities, Support Services, and Technology Committee, Fall 2008 – Winter 2010.

- Member, College of Engineering Director of Business Search Committee, Fall 2009 –

Winter 2010.

- Member, University Graduate Professional Fellowship Review Panel, 2008

College/Department Committee Chaired

- **Overall Coordinator**, Interdisciplinary M.S. in AI Program, College of Engineering, Wayne State University, Detroit, August 2022 – Now.

- **Director**, Interdisciplinary M.S. in AI Program (Systems and Hardware Track), College of Engineering, Wayne State University, Detroit, August 2022 – Now

- **Team Leader of college efforts to develop the interdisciplinary M.S. in AI Program**, 2021 – current

- **Chair**, Computer Engineering Area Committee, 2017 – current.

- **Coordinator,** Computer Engineering Graduate Programs, 2021 – current

- Coordinator, Prelim Exam Committee on Computer Organization, since 2003

- Coordinator, Prelim Exam Committee on Data Structures and Algorithms, since 2015

- **Chair,** Faculty Search Committee, 2017/2018

- **Chair**, College Faculty Assembly, Fall 2010 – Winter 2012

- **Director of the Graduate Program** and the **Chair of Graduate Committee**, Electrical and Computer Engineering Department, August 2011 - January 2013.

- **Chair**, College Bylaws Subcommittee, Fall 2011 - Winter 2012.

- **Chair**, Graduate Committee, August 2011 – January 2013

- **Chair**, Computer Engineering Taskforce, 2014- 2016

College Committee Membership

- Member College Academic Operations Committee, 2022/2023, 2021/2022, 2020/2021, 2019/2020

- Member, College Ranking/Reputation Committee, 2020/2021

- Member, ECE-CS Curriculum Collaboration Committee, 2015/2016 – 2017/2018.

- Member, ECE-CS Curriculum Collaboration Committee, 2015/2016 – Current

- Member, College Graduate Program Committee, 2012 - 2014.

- Member, College Faculty Assembly Executive Committee, Fall 2008 – Winter 2010

- Member, Director of Business Affairs Search Committee, Fall 2009 – Winter 2010

- Member, College of Engineering Distance Learning Task Force, Winter 2010

- Member, College of Engineering Strategic Planning, Winter 2010.

- Member, College Computer Advisory Committee, 2003-2004, 2005-2006, 2006-2007, 2007-2008

- Member, College Retention Committee, 2006-2007

Department Committee Membership

- Member, Salary Committee, 2022/2023, 2020/2021

- Member, Faculty Search Committee, 2019/2020, 2016/2017

- Member, Graduate Curriculum Committee, almost regularly since 2003

- Member, Salary Committee, 2020/2021

- Member, ECE Budget Advisory Committee, 2015/2016

- Member, Undergraduate Curriculum Committee, 2022/2023, 2004- 2016.

- Member, ECE Future Directions Taskforce, 2014/2015, 2014/2016

- ECE Seminar Coordinator, 2014/2015

- IEEE Faculty Counselor, 2006 – 2014

- Member, Tenure, Promotion, Budget, and Salary Committee, 2006-2007

- Member, Faculty Search Committee, 2004-2005, 2005-2006